



Early Warning for All Supported by FengYun Satellites



WEI ZHENG (zhengw@cma.gov.cn)

**National Satellite Meteorological Center
(National Center for Space Weather)
China Meteorological Administration**

AOMSUC-13

3 - 10 November 2023
Busan, Korea

Hosted by Korea Meteorological Administration





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9 FengYun Satellites in orbit

GEO

FY-2G, -2H

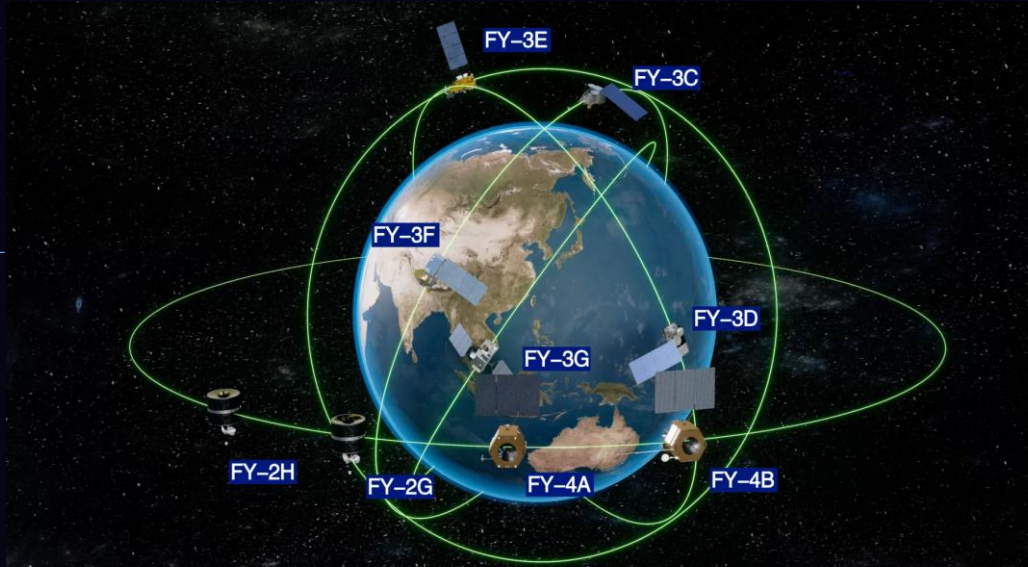
FY-2G (99.5°E) and FY-2H (79°E)
 Full disk every 30 min
 FY-2H, last flight unit of FY-2 series.

FY-4A, -4B

China's second generation GEO meteorological satellites.

FY-4A (104.7°E) , Full disk every 15 min.

FY-4B (133°E), Full disk every 15 min, partial areas rapid scanning at 1 min.



LEO

FY-3C

Mid-morning orbit
 Operational with degraded performance

FY-3D

Afternoon orbit,
 10 EO instruments

FY-3E

Early-morning orbit
 11 EO instruments

FY-3F

Morning orbit, successor of FY-3C
 Launched on August 3, 2023

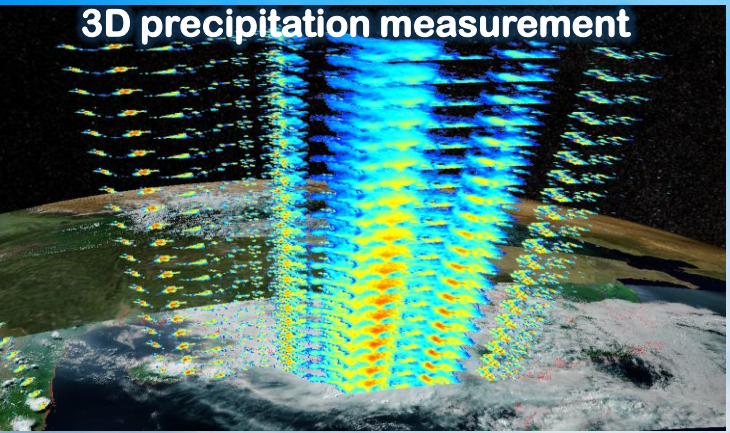
FY-3G

China's first precipitation measurement satellite, launched on April 16, 2023



Demonstration

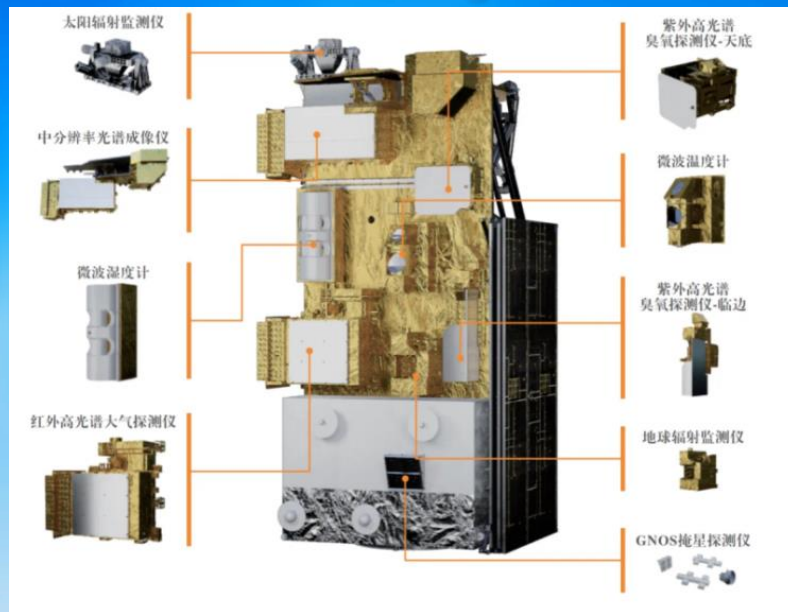
- FY-3G launched on Apr.16,2023 is the first precipitation measurement satellite of the FY-3 series.
- Operates in a 50° inclination orbit, equipped with Ku/Ka-band dual-frequency precipitation measurement radar, and 4 other sensors.
- Measure the 3D structure of precipitation, obtains cloud microphysical parameters.
- Creating an active-passive combined comprehensive FengYun precipitation measurement system.



Product Type	Product Name	Instrument Name
Cloud radiation	Cloud detection	MERSI-RM
	Cloud cover	MERSI-RM
	Cloud phase state and cloud type	MERSI-RM
	Cloud top properties (temperature, height, intensity of pressure)	MERSI-RM
Sea/land surface	Land surface temperature	MERSI-RM,MWRI-RM
	Snowdepth/snow water equivalent	MWRI-RM
	Soil moisture	MWRI-RM
	Soil freeze-thaw	MWRI-RM
	Emissivity	MWRI-RM
	Sea surface temperature	MERSI-RM,MWRI-RM
	Sea surface wind speed	MWRI-RM,GNOS-II
	Atmospheric precipitable water	MERSI-RM,MWRI-RM
Atmospheric parameters	Precipitation (surface precipitation, precipitation rate)	MWRI-RM,PMR
	Cloud water content	MWRI-RM
	Atmospheric temperature profile	MWRI-RM
	Occultation atmosphere (atmospheric curvature angle, atmospheric refractive index, atmospheric density, atmospheric temperature and humidity profile)	GNOS-II
	Bright band detection	PMR
	Precipitation type	PMR
	Precipitation phase state	PMR
	Equivalent radar reflectivity factor profile	PMR
	3D raindrop spectral parameter profile	PMR
	3D precipitation rate profile	PMR
Latent heat	PMR	
Space weather	Electron density profile	GNOS-II

- FY-3F launched on Aug.3, 2023 is the newest member of FengYun Constellation with an international advanced load configuration and performance.
- Replace FY-3C' s duties of providing services in weather forecasting, climate prediction, disaster monitoring, and environmental monitoring.
- Equipped with both microwave and optical instruments, which allows vertical detection of atmospheric temperature and humidity stratification up by over 40 times than previous design.
- Upgraded ultraviolet detection capability, and is equipped with two newly developed ultraviolet hyperspectral remote sensing detectors.

Instrument Payloads



Orbit	Sun-synchronous orbit
Altitude	836 km
ECT	10:00~10:20 desc
Launch	2023-08-03
End of service	≥2031

FengYun GEO Constellation

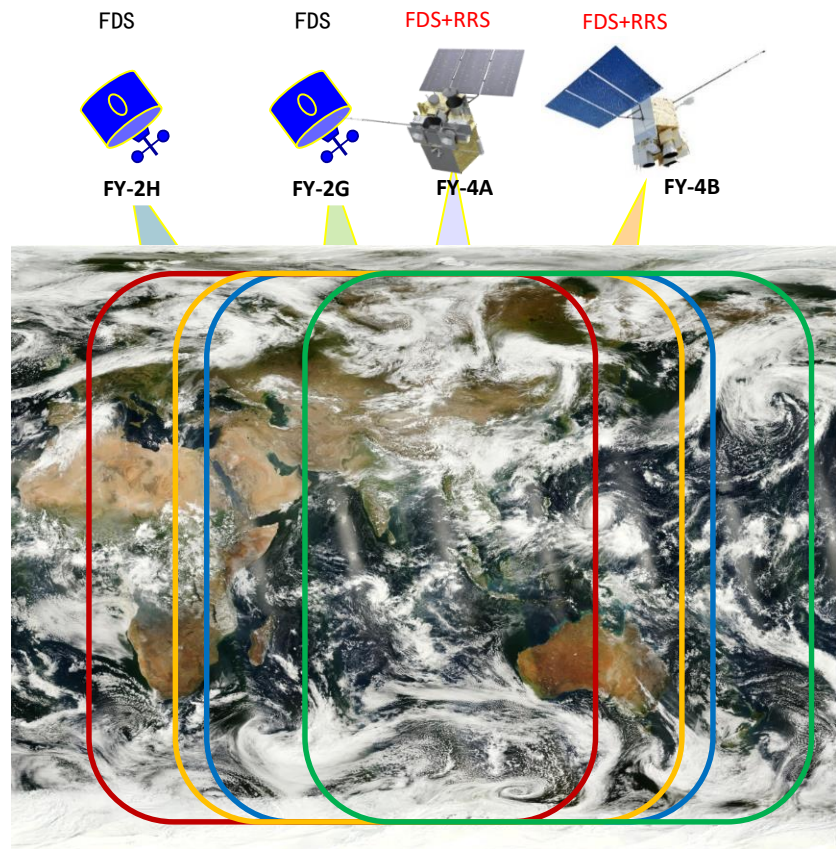
■ 4 in operation

FY-2H: Full Disk (79° E)

FY-2G: Full Disk (99.5° E)

FY-4A: Full Disk + Regional Rapid (105° E)

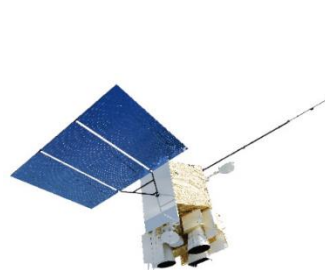
FY-4B: Full Disk + Regional Rapid (133° E)



FengYun GEO Constellation

- FY-4B, the second satellite of FY-4 series, was designed to be **the first operational satellite** of FY-4 series
- Launched on June 3, 2021.

	FY-4A(EXP)	FY-4B(OP)
Stabilization	Three-axis	Three-axis
Designed Life	5~7 Years	7-10 Years
Observation efficiency	85%	85%
Observation Mode	Imaging +Sounding + Lightning Mapping	Imaging +Sounding
Main Instruments	AGRI :14 channels SSP Resolution: 0.5~4Km Global imaging: 15min Flexible imaging : 2D	AGRI :15 channels SSP Resolution: 0.5~4Km Global imaging: 15min Flexible imaging : 2D
	GIIRS: SSP Resolution:16Km Spectral Resolution: 0.625cm ⁻¹	GIIRS: SSP Resolution:12Km Spectral Resolution: 0.625cm ⁻¹
	LMI: SSP Resolution:7.8Km	GHI: 7 channels SSP Resolution 0.25-2Km
	SEP High energy particles	SEP High energy particles Magnetic field



Geostationary High-speed Imager (GHI)



Geostationary Interferometric Infrared Sounder (GIIRS)



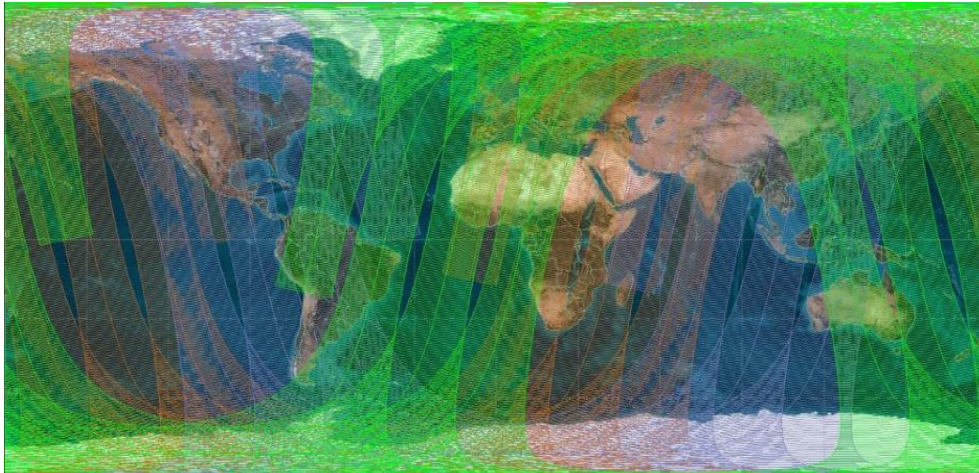
Space Environment Monitoring Instrument Package (SEP)



Advanced Geostationary Radiation Imager (AGRI)

FY-3E

- **FY-3E** is the world's **first** meteorological satellite in **early morning orbit for civil service**, filling in the observing gap in early morning.
- Solar X-ray Extreme Ultraviolet Imager (X-EUVI) is the first space solar telescope of China.



FY-3 Early Morning 6:00 AM

Metop-A 9:30 AM

NPP 13:30 PM

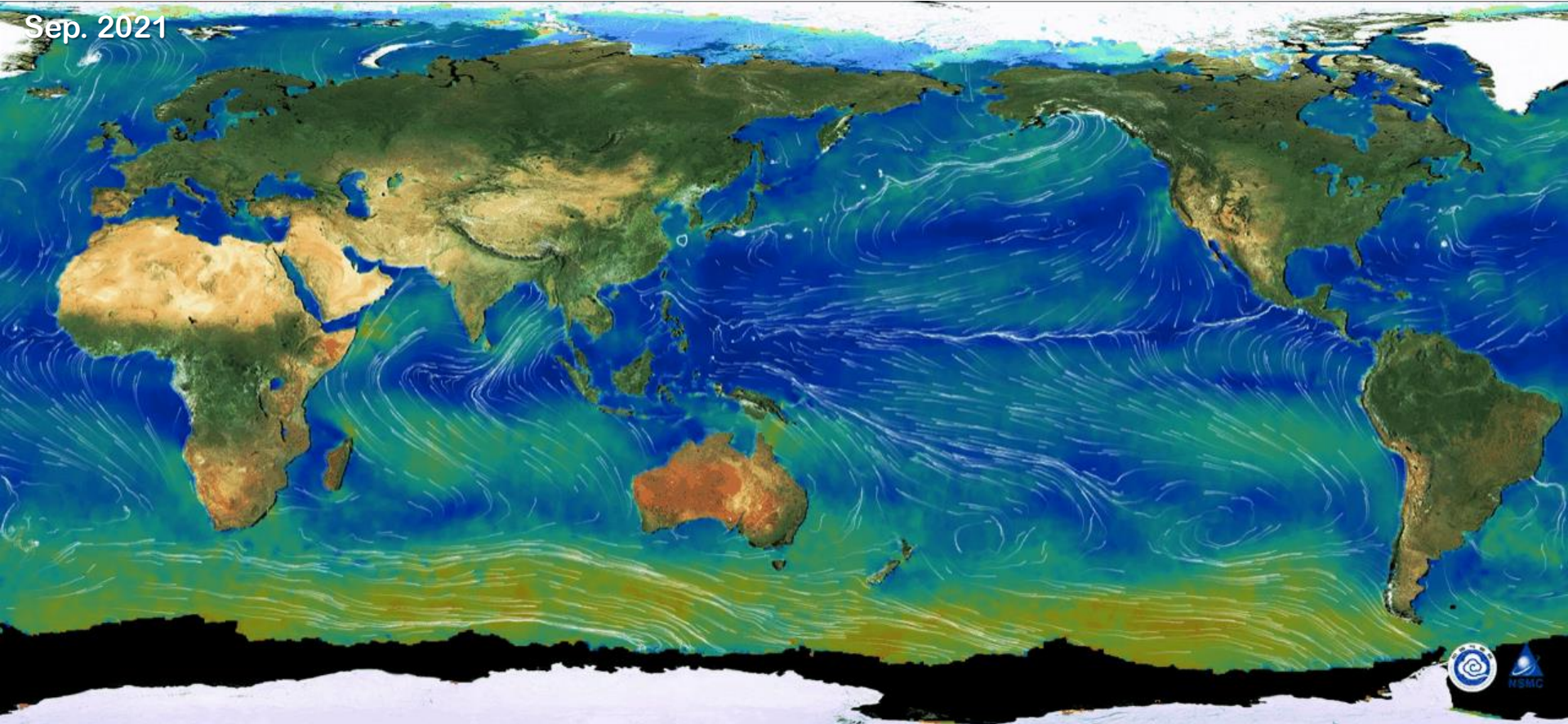
- **Launched on July 5, 2021.**

Improved
Improved
Improved
Successful
Improved
Improved
Completely New
Improved
Improved
Completely New
Completely New
New

Satellite Payload	
Acronym	Full name
GNOS-2	GNSS Radio Occultation Sounder -2
HIRAS-2	Hyper-spectral Infrared Atmospheric Sounder -2
MERSI-LL	Medium Resolution Spectral Imager -LL
MWHS-2	Micro-Wave Humidity Sounder -2
MWTS-3	Micro-Wave Temperature Sounder -3
SIM-2	Solar Irradiance Monitor - 2
SSIM	Solar Spectral Irradiance Monitor
SWS/Tri-IPM	SWS / Triple-angle Ionospheric PhotoMeter
SES/SEM	SES / SEM(FY-3E)
WindRAD	Wind Radar
XEUVI	Solar X-ray and Extreme Ultraviolet Imager

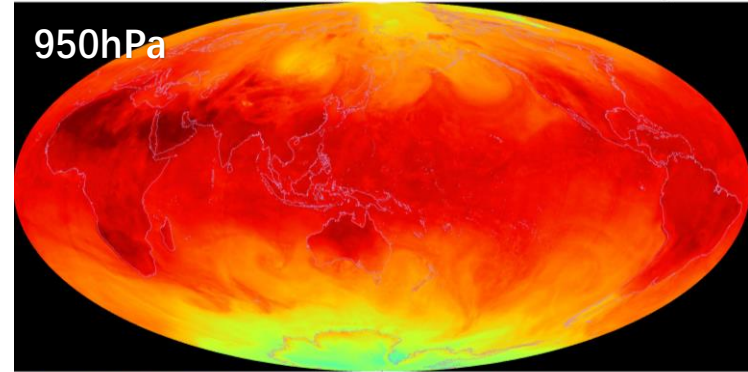
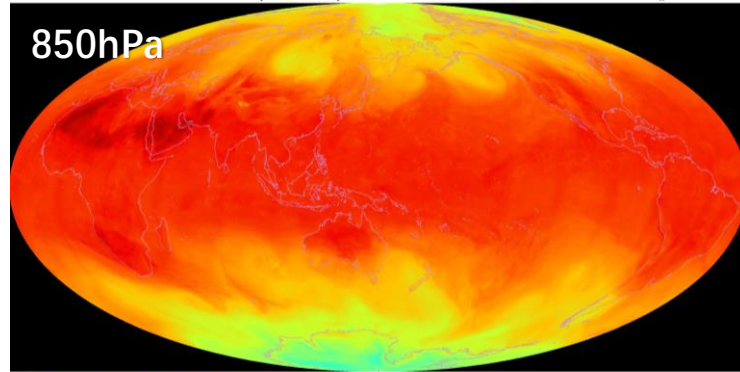
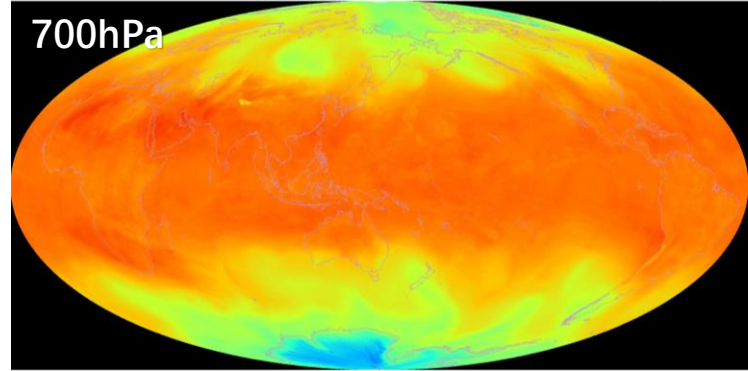
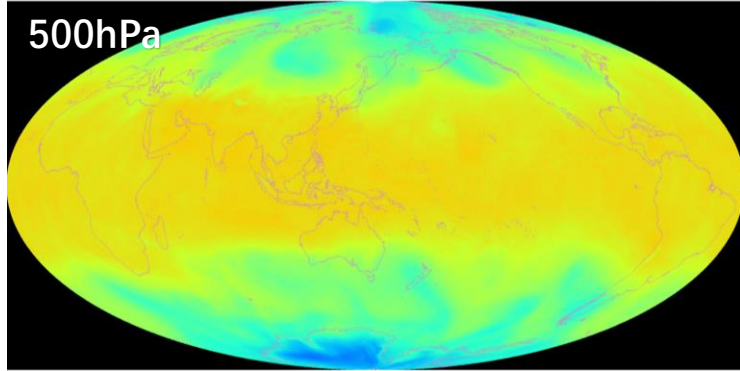
FY-3E Sea surface wind

Sep. 2021



FY-3E temperature

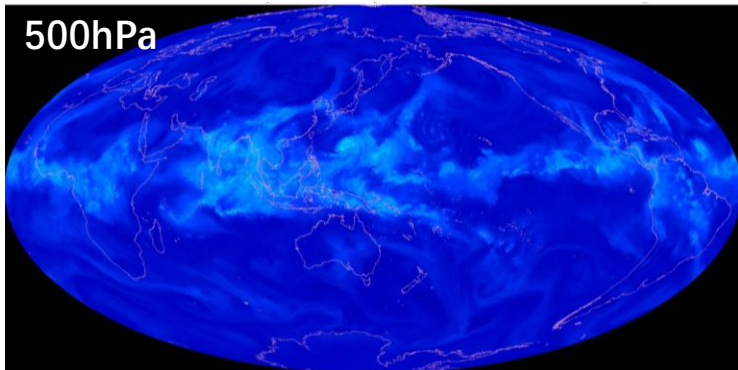
2021.9.27



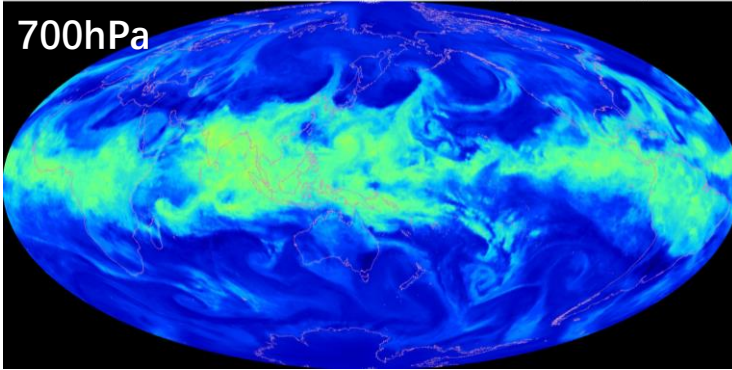
FY-3E global humidity image

2021.9.27

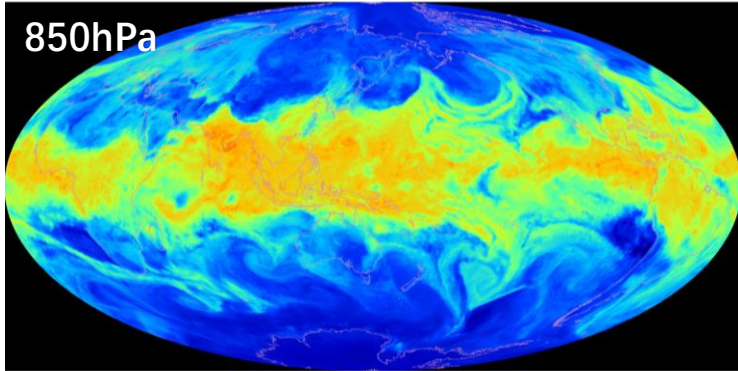
500hPa



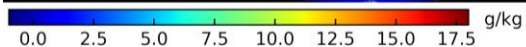
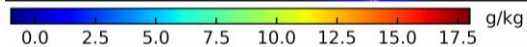
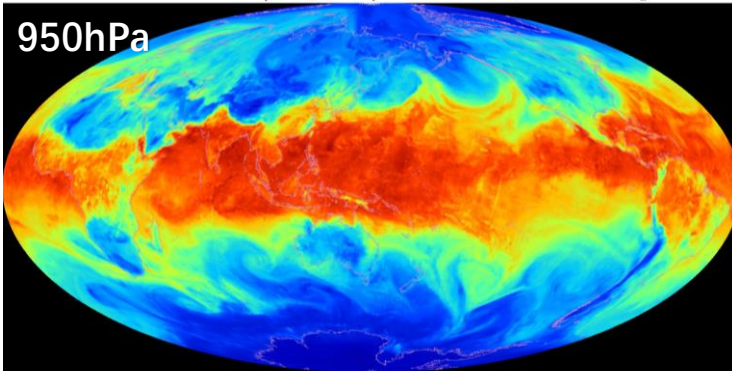
700hPa



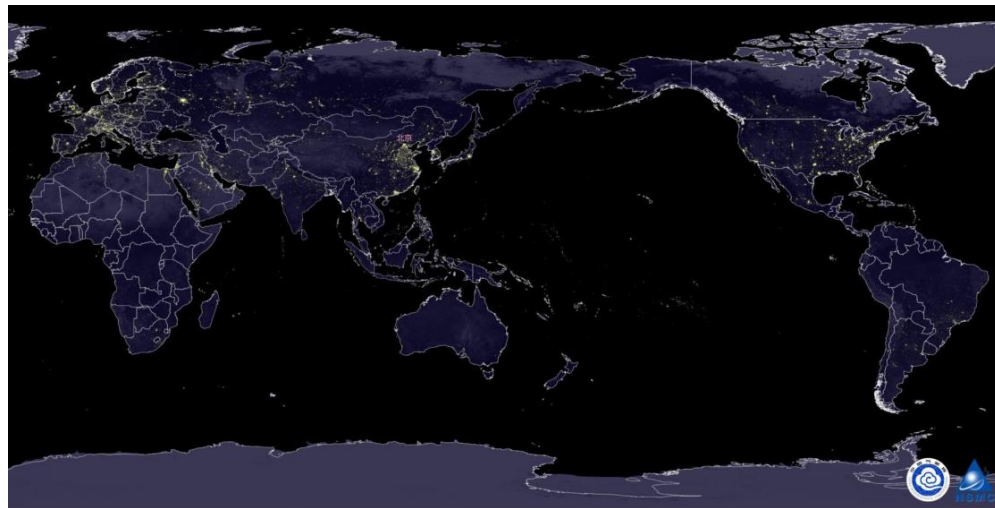
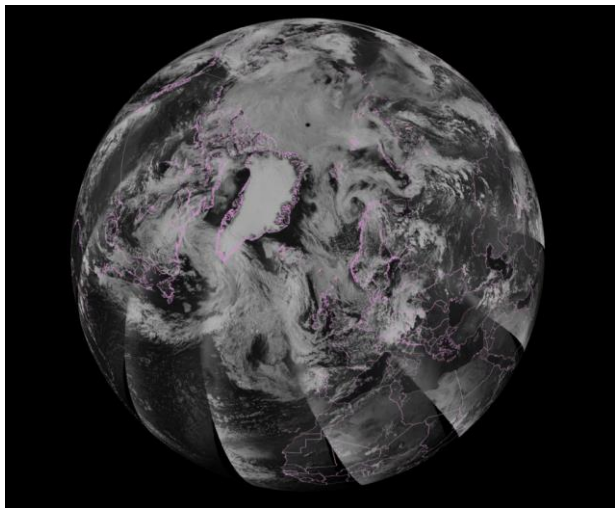
850hPa



950hPa

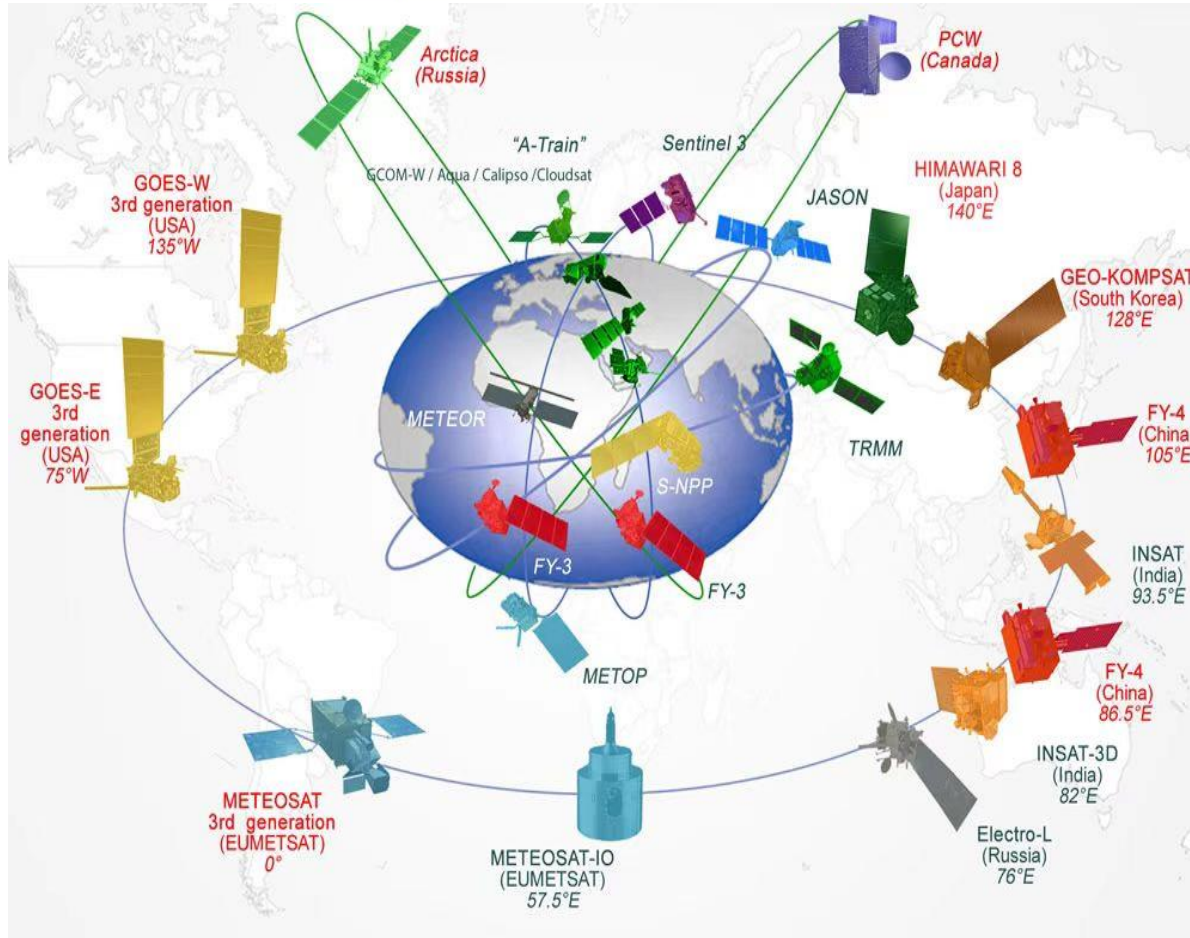


FY-3E City Light Monitoring



FengYun Constellation

Space-based WMO Integrated Global Observing System



FengYun Constellation– Ground Receiving Station Network



Well-organized Receiving System Ensures Data Services





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FengYun Products

Atmosphere (30+)

- Aerosol
- *Aerosol optical thickness*
- Aerosol over Land Surface
- Total Precipitable Water
- Precipitation
- Rain Type
- Rain Phase
- Radar Rain Rate
- Atmospheric bending angle
- Atmospheric refractive index
- *Atmospheric density*
- Electron density profile
 - *total sulfur dioxide column*
 - *Total Nitrogen Dioxide column*
- Atmospheric humidity profile (GNOS)
- Atmospheric temperature profile(MWTS-III, MWRI, GNOS)
- Atmospheric temperature and humidity Profile(MWHS-II)
- Atmospheric temperature and humidity Profile(HIRAS/MWHS-II/MWTS-III)
- Atmospheric temperature and humidity Profile(MWHS-III/HIRAS)
- Atmospheric temperature and humidity Profile(MWTS-III/HIRAS)
- Atmospheric temperature and humidity Profile(MWHS-II/MWTS-III/MWRI)
- *Total oxygen column*
- *Carbon dioxide mixing ratio*
- *Methane mixing ratio*
- total ozone column
- *Nadir Ozone vertical profile*
- *Limb Ozone vertical profile*
- Aerosol over Ocean
- Total *Precipitable Water over Ocean*

Ocean

- MERSI Sea Surface Temperature
- *MWRI Sea Surface Temperature*
- *MWRI Sea surface wind direction*
- GNOS Sea surface wind Speed
- PR Sea surface wind Speed
- PR Sea surface wind direction

Ice&Snow

- Sea ice
- Snow Cover
- Snow Depth
- SWE
- Polar Sea Ice Cover

Cloud & Radiation (10+)

- Equivalent emission radiation for clear sky
- *OLR of HIRAS*
- *Cloud Top Parameters*
- Top-up Radiation and Clouds
- Surface radiation budget
- *Total solar irradiance downward from the atmospheric top*
- *solar band irradiance at the top of the atmosphere*
- Cloud Mask
- Cloud Amount
- Cloud Classification
- *Cloud Top Temperature/Cloud Top Pressure*
- *Cloud Optical Depth*
- *the Effective Radius of Cloud*
- Outgoing Longwave Radiation
- *Polar Winds*
- *Water leaving Reflectance*
- *Cloud Liquid Water Content*

Space Weather (10+)

- *zeta potential*
- *Radiation dose*
- *Magnetic field*
- *particle(Medium and high energy proton, Electronic three-directional flow, Particle throw angle)*
- *scan imaging*
- *Push-broom scan imaging*
- *Aurora egg morphology*
- *Particle sedimentation*
- *IPM night product*
- *IPM daytime product*
- *IPM multi-angle product*
- *Solar extreme ultraviolet imager*
- *solar x ray imager*

Biology

- *Leaf area index*
- Fraction of Photosynthetically Active Radiation
- Net Primary Production
- *Chlorophyll fluorescence*

Land (10+)

- Land Reflectance Factor
- Land Surface Temperature
- *Land Surface Bidirectional Reflection/ Albedo*
- *Land Cover*
- Dust Product
- *Near-Constant Contrast Image*
- *City Light/Urban low-light background mosaic*
- *Land Surface Temperature*
- *Soil moisture content*
- Surface pressure
- surface reflectance

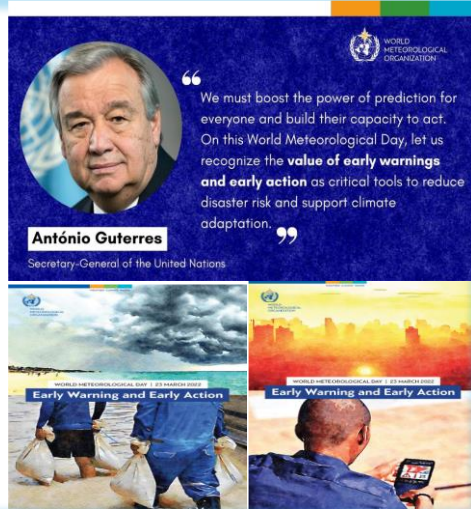
• *Vegetation Index*

FengYun Satellite Support Sustainable Development Goals (SDGs)



FengYun Satellites Support Early Warning Actions

The United Nations will spear-head new action to ensure every person on Earth is protected by early warning systems within five years.



WORLD METEOROLOGICAL ORGANIZATION

“ We must boost the power of prediction for everyone and build their capacity to act. On this World Meteorological Day, let us recognize the **value of early warnings and early action** as critical tools to reduce disaster risk and support climate adaptation. ”

António Guterres
Secretary-General of the United Nations

WORLD METEOROLOGICAL DAY 1-23 MARCH 2022
Early Warning and Early Action

WORLD METEOROLOGICAL DAY 1-23 MARCH 2022
Early Warning and Early Action

UN: Global Early Warning Initiative



EARLY WARNINGS FOR ALL
The UN Global Early Warning Initiative for the Implementation of Climate Adaptation

WORLD METEOROLOGICAL ORGANIZATION

COP27
EGYPT 2022

**EARLY WARNINGS FOR ALL
ACTION PLAN**

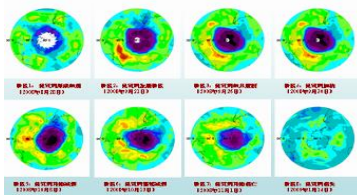
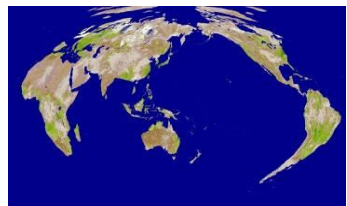
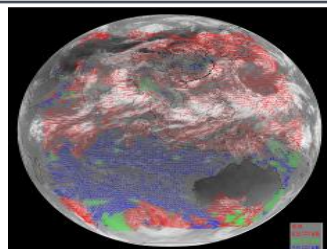
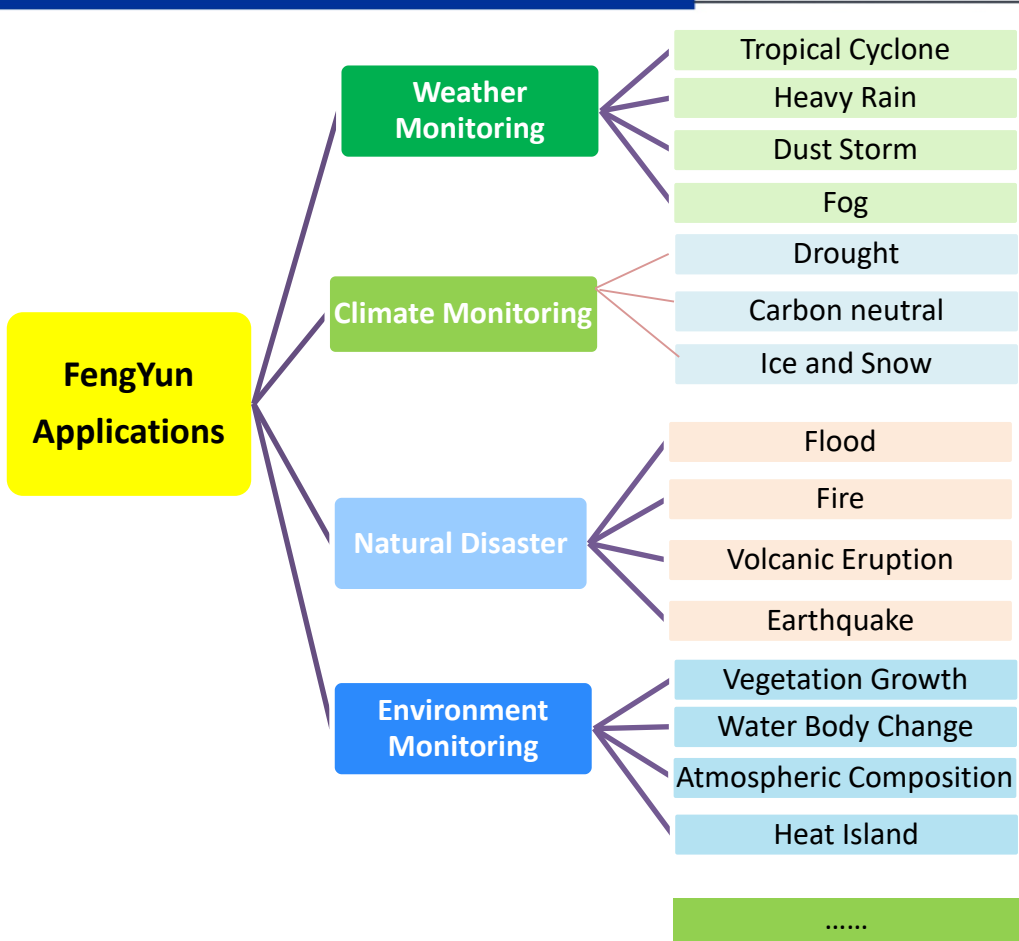
Today, one third of the world's people, mainly in least developed countries and small island developing states, are still not covered by early warning systems... This is unacceptable, particularly with climate impacts sure to get even worse. Early warnings and action save lives. To that end, today I announce the United Nations will spearhead new action to ensure every person on Earth is protected by early warning systems within five years. I have asked the World Meteorological Organization to lead this effort and to present an action plan at the next UN climate conference, later this year in Egypt.

UN Secretary-General
António Guterres on
World Meteorological Day
23 March 2022

The diagram illustrates a circular process for early warning systems. At the center is 'PEOPLE CENTERED MULTI HAZARD EARLY WARNING SYSTEMS (MHEWS)'. Surrounding this are four main components: 'IMPROVED OBSERVATION CAPABILITY' (top left), 'IMPROVED FORECASTING CAPABILITY' (top right), 'IMPROVED COMMUNICATION CAPABILITY' (bottom right), and 'IMPROVED RESPONSE CAPABILITY' (bottom left). Arrows indicate a clockwise flow between these components. The outer ring of the diagram lists various stakeholders: 'GOVERNMENTS', 'COMMUNITIES', 'INDUSTRY', 'ACADEMIA', 'RESEARCHERS', 'POLICYMAKERS', 'OPERATIONAL AGENCIES', 'OPERATIONAL SERVICES', 'OPERATIONAL USERS', 'OPERATIONAL PROVIDERS', 'OPERATIONAL SUPPORTERS', and 'OPERATIONAL PARTNERS'.

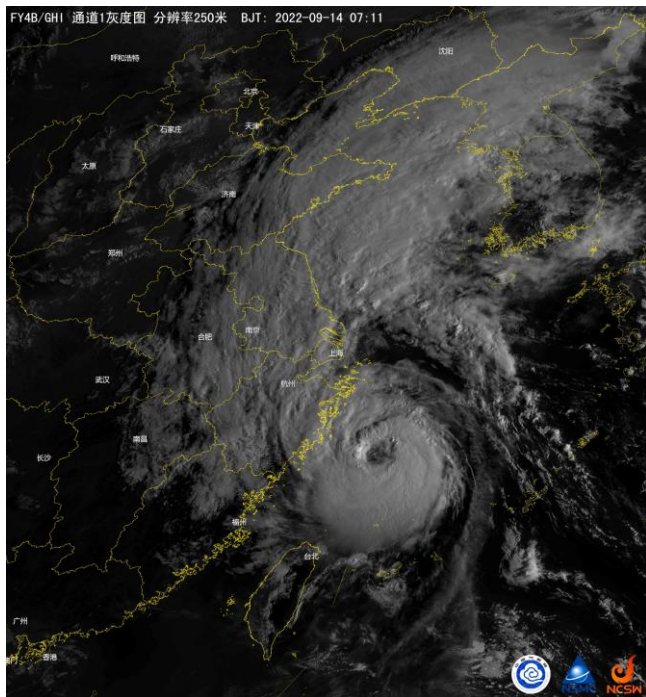
WMO: Early Warnings for All

Fengyun Applications

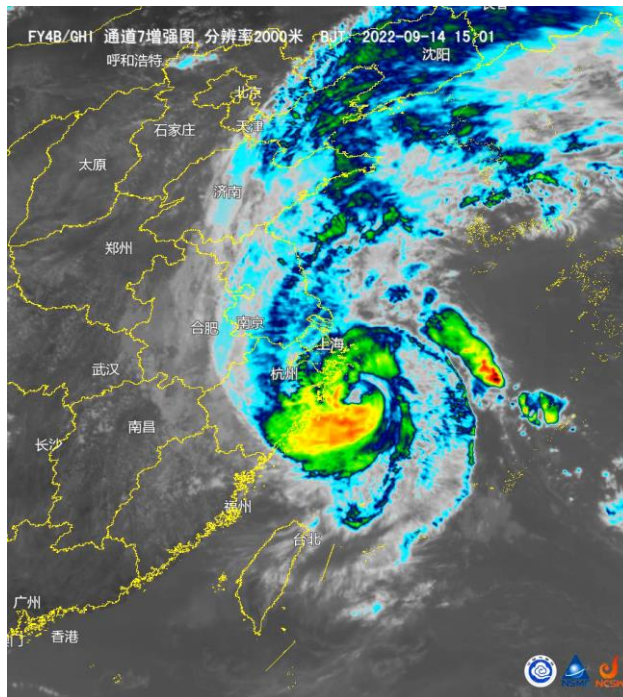


Applications: Weather Monitoring

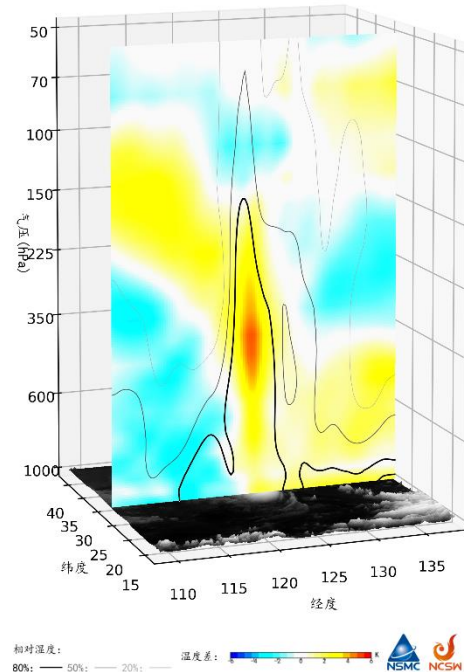
Severe Typhoon MUIFA



FY-4B cloud image



FY-4B Infrared enhanced image

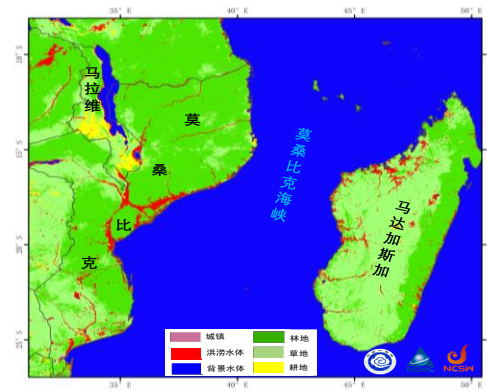
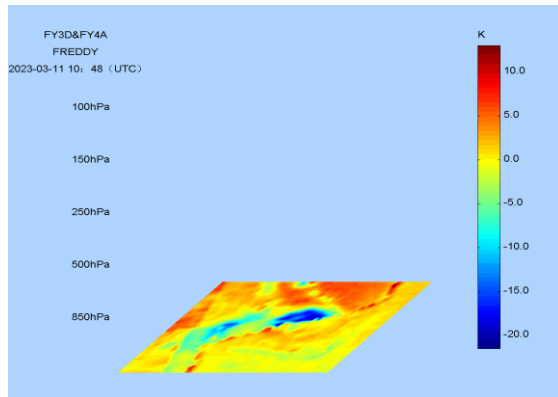
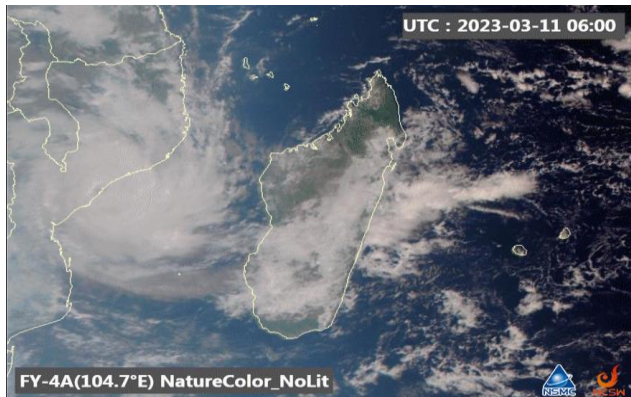


Structure Diagram of Typhoon Warm Center

Applications: Weather Monitoring

The Tropical Cyclone FREDDY

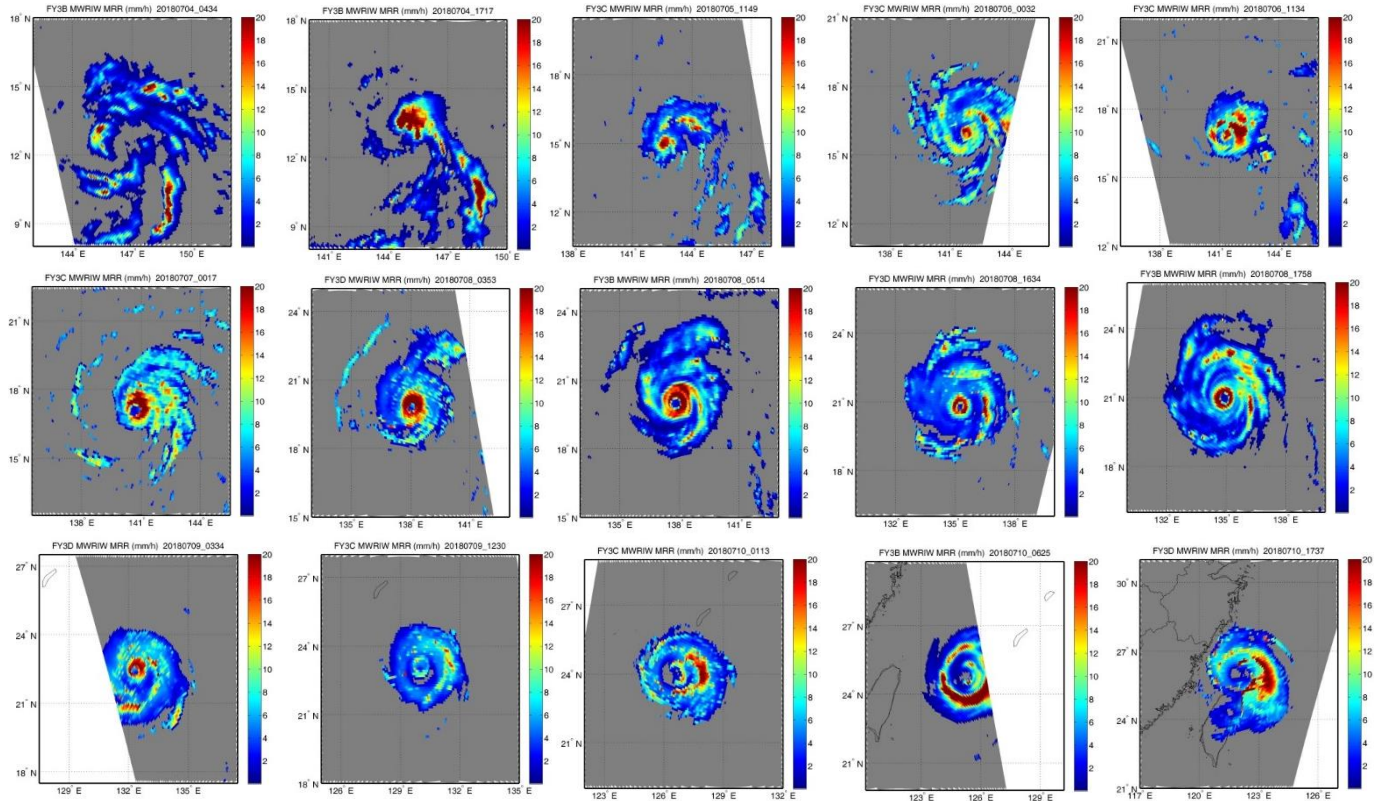
- The cyclone FREDDY is set to break records for the **longest-lasting storm**, it has already caused **immense damage** in Mozambique and Madagascar;
- FengYun meteorological satellite have monitored the **entire movement and development** of FREDDY



Applications: Weather Monitoring

FY-3B/C/D continuously track and monitor the typhoon “Maria” precipitation.

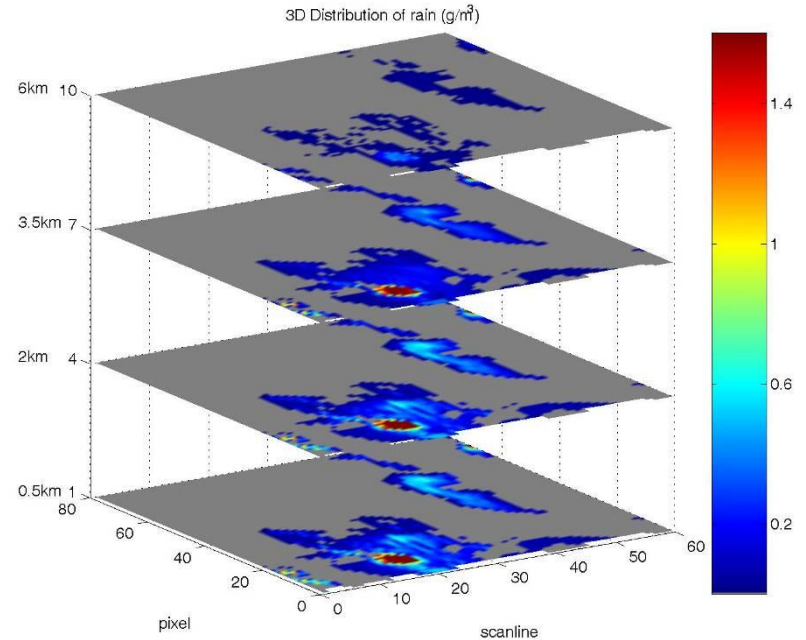
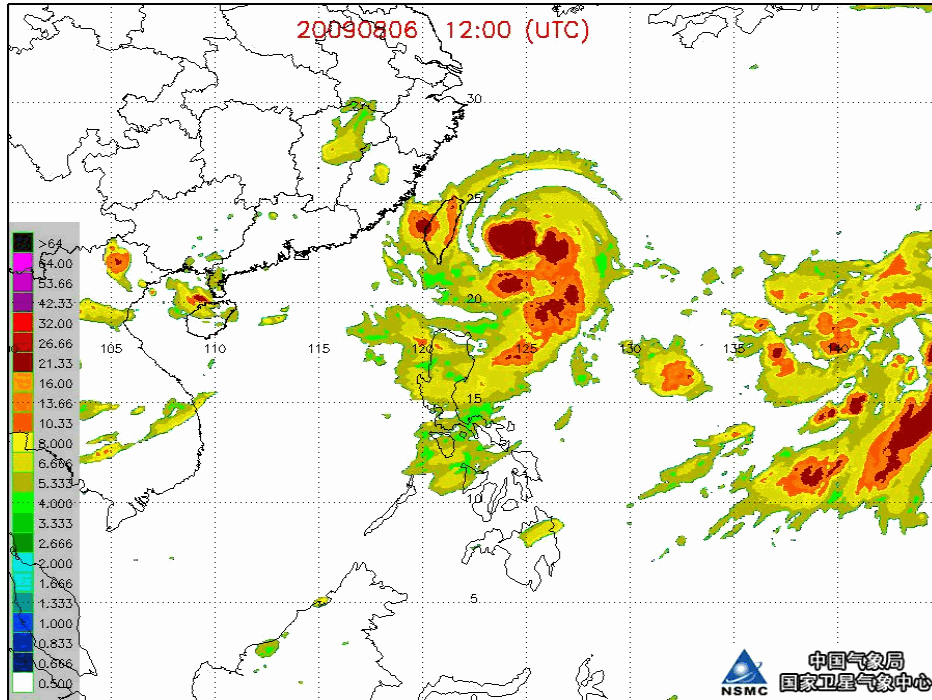
The strong precipitation belt gradually transitions from the wind eye wall to the peripheral spiral cloud belt



Applications: Weather Monitoring

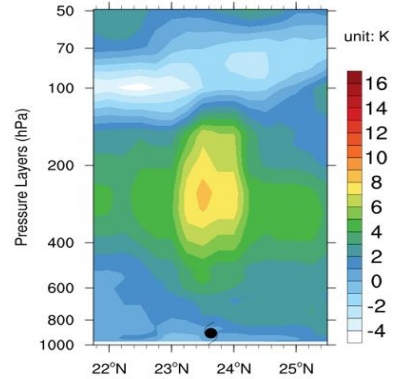
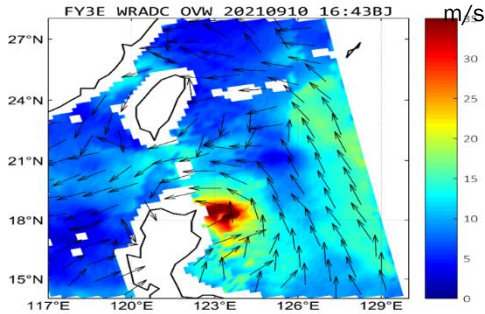
3D precipitation analysis

- Strong rainfall structure within Typhoon related highly with low frequency map (10 and 18 GHz)

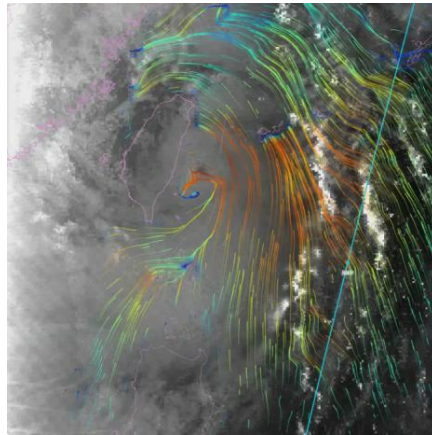
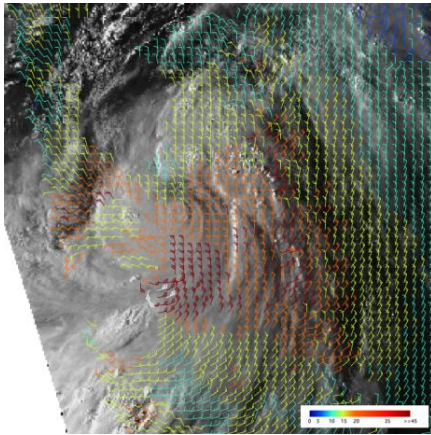


Applications: Weather Monitoring

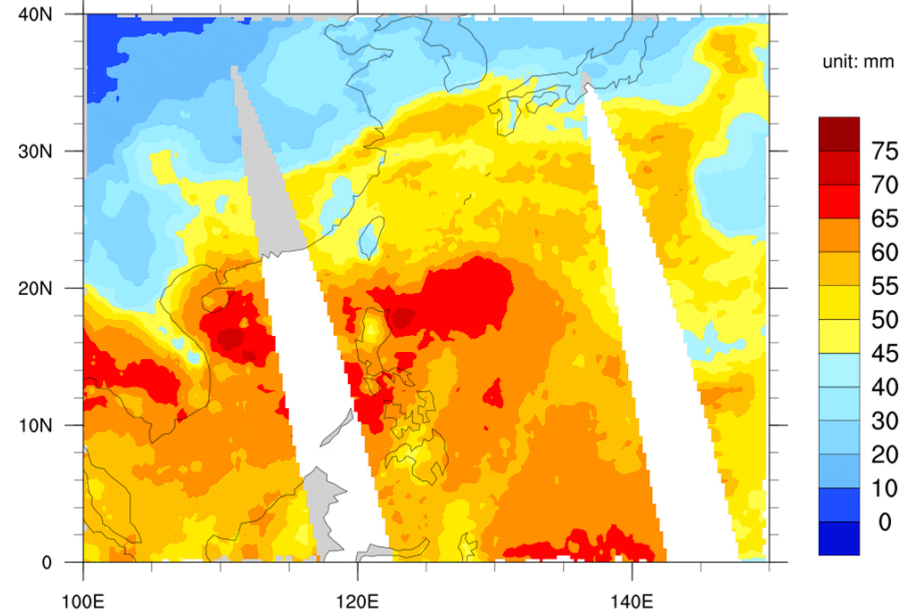
FY-3E products



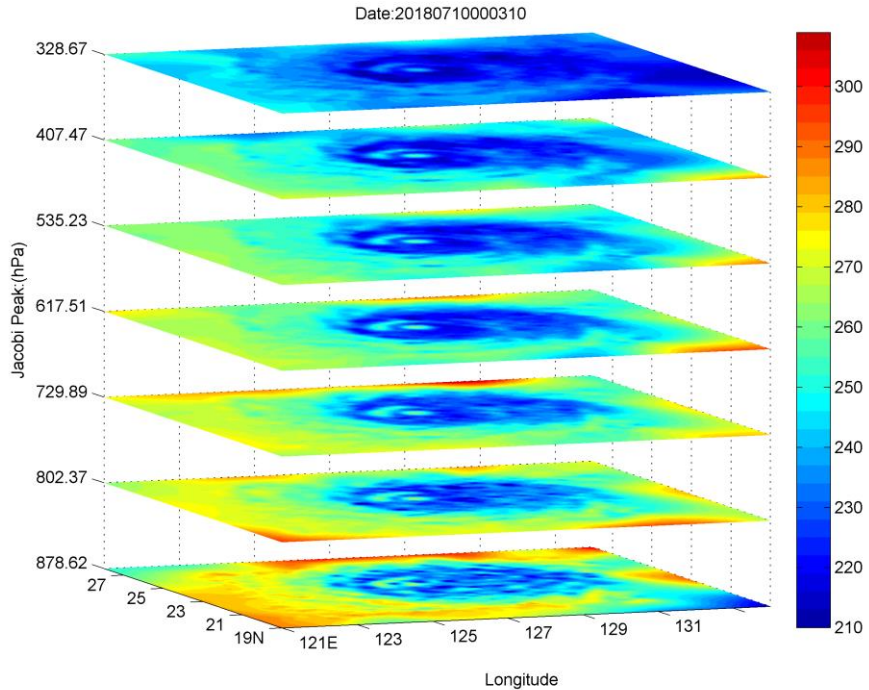
FY-3E Low-light cloud at night



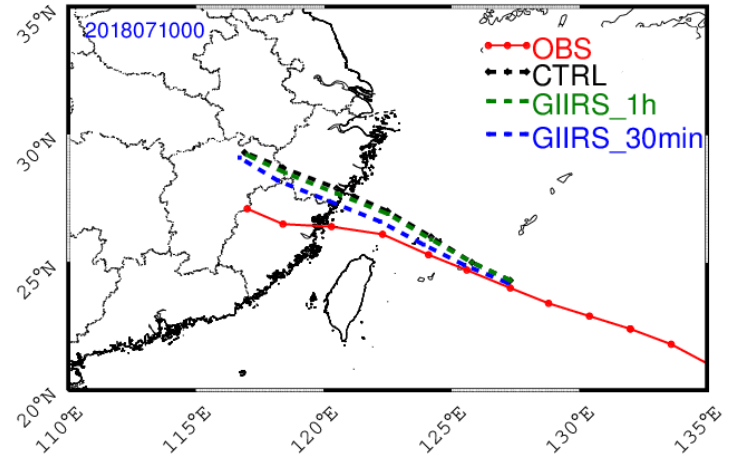
Total Precipitable Water (mm) 2021-09-10 (13:30 Local Time)



Applications: Weather Monitoring



Impact of GIIRS high temporal observations on Typhoon Maria forecasts (72-h)

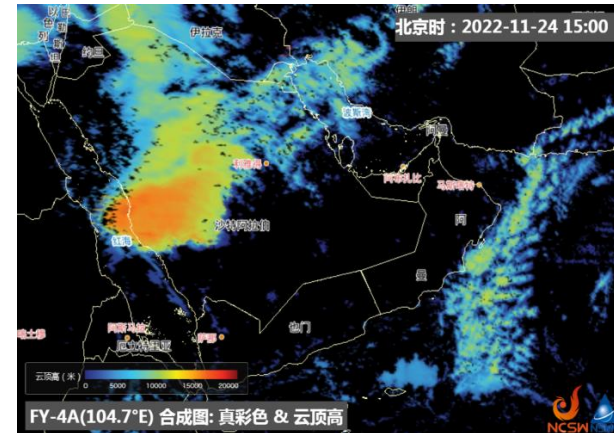
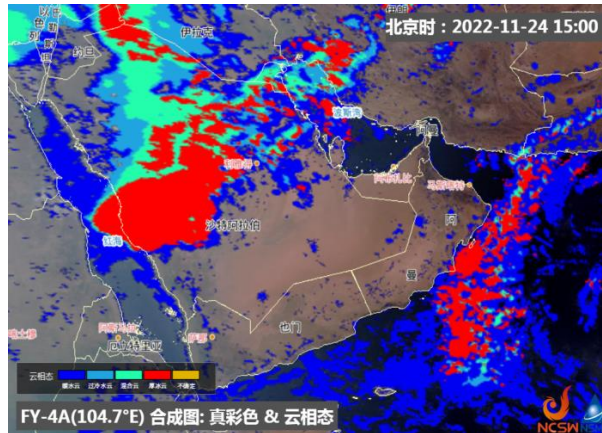
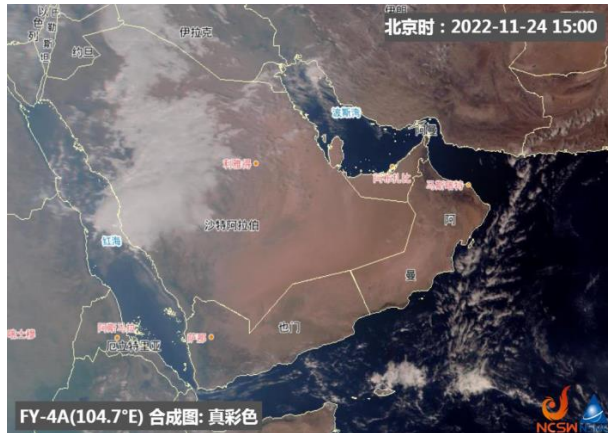
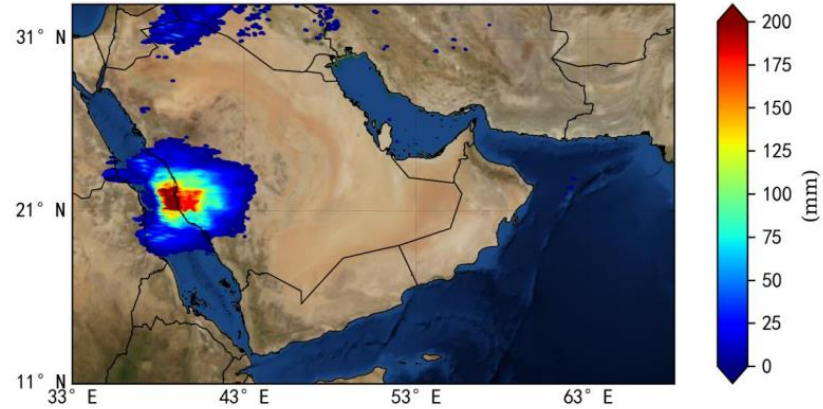


Applications: Weather Monitoring

The Heavy Rain Monitoring over Saudi Arabia

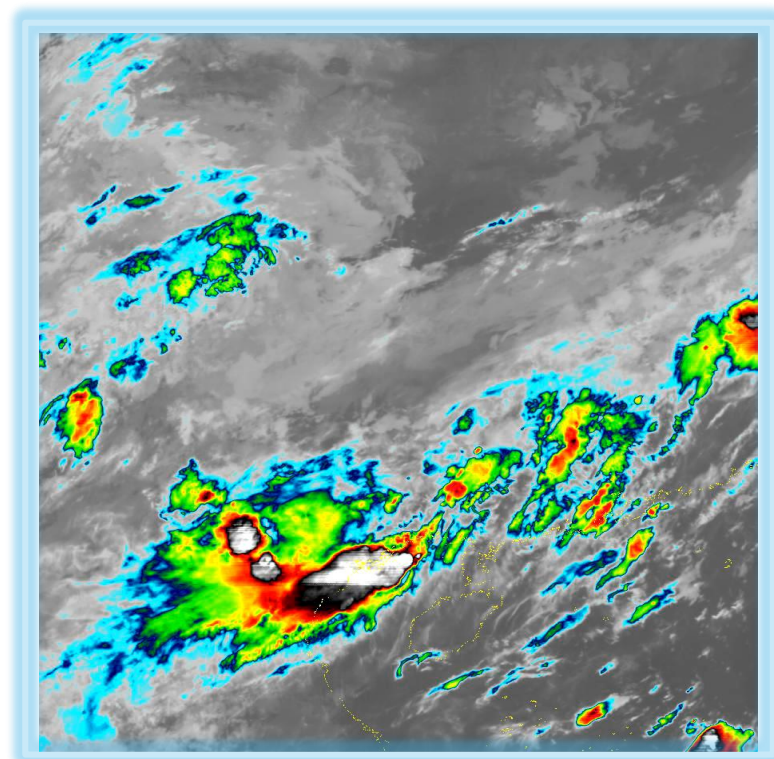
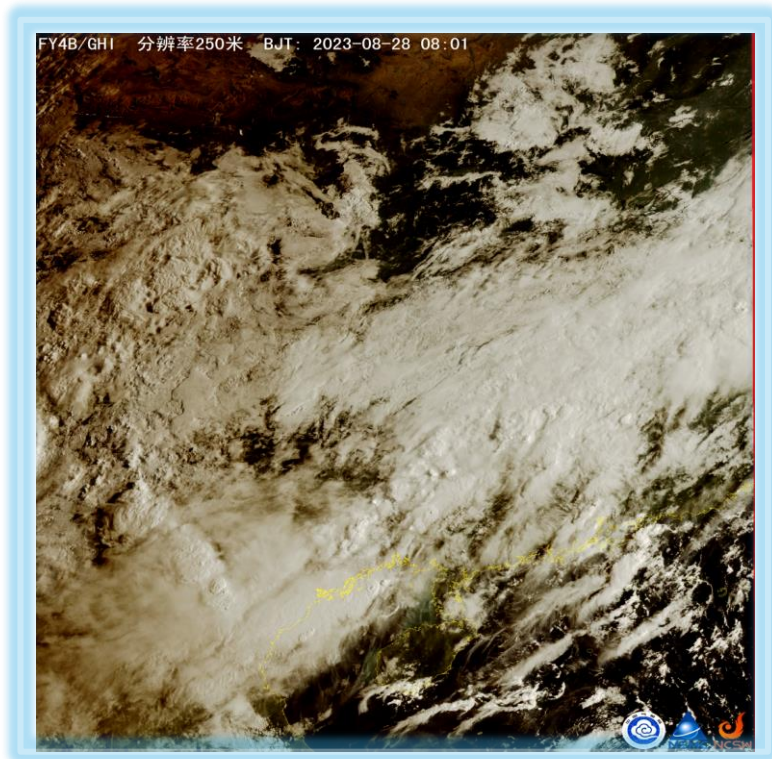
- **Severe flash flooding** struck in western parts of Saudi Arabia after torrential rain on 24 November 2022, the city of Jeddah in Mecca Province recorded **179 mm of rain in 6 hours**;

卫星估计累积降水量(11月24日 07:00 - 11月25日 07:00)



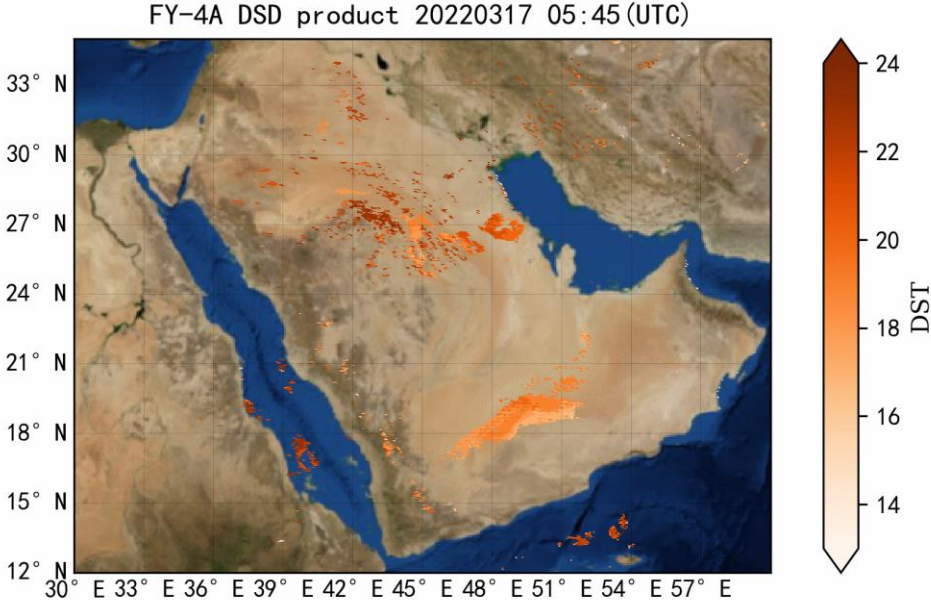
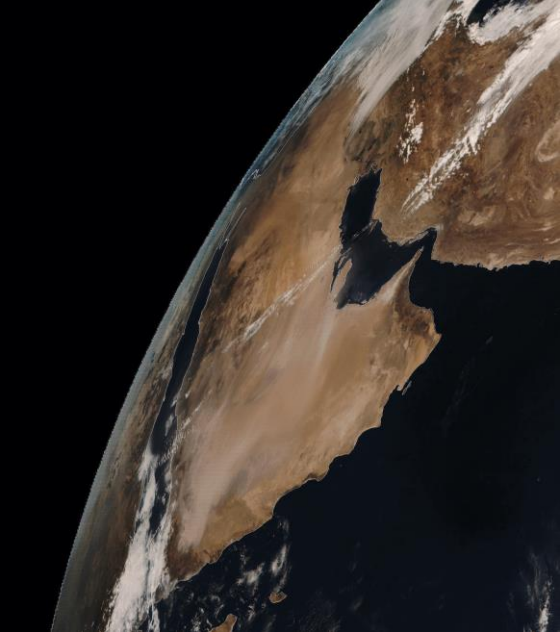
Applications: Weather Monitoring

Severe Convection



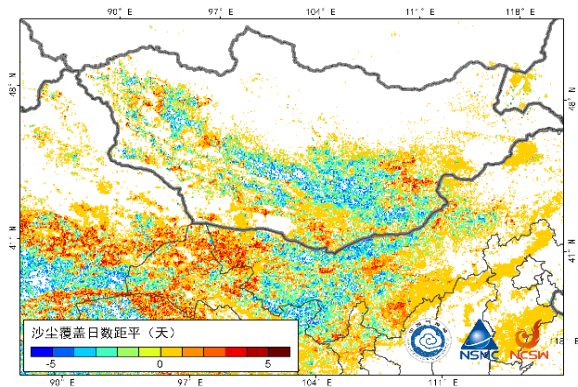
Applications: Weather Monitoring

The Dust Storm Monitoring in Saudi

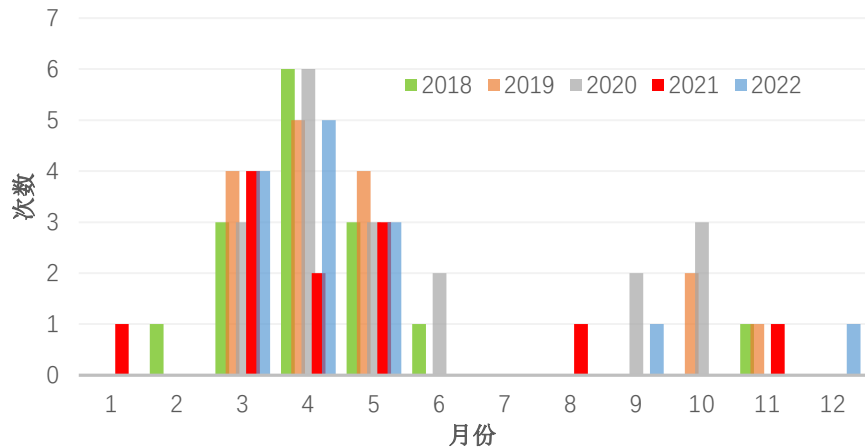
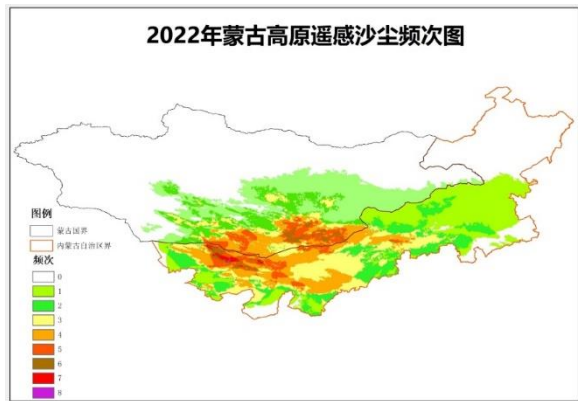


Applications: Weather Monitoring

Dust storm monitoring over Mongolian Plateau



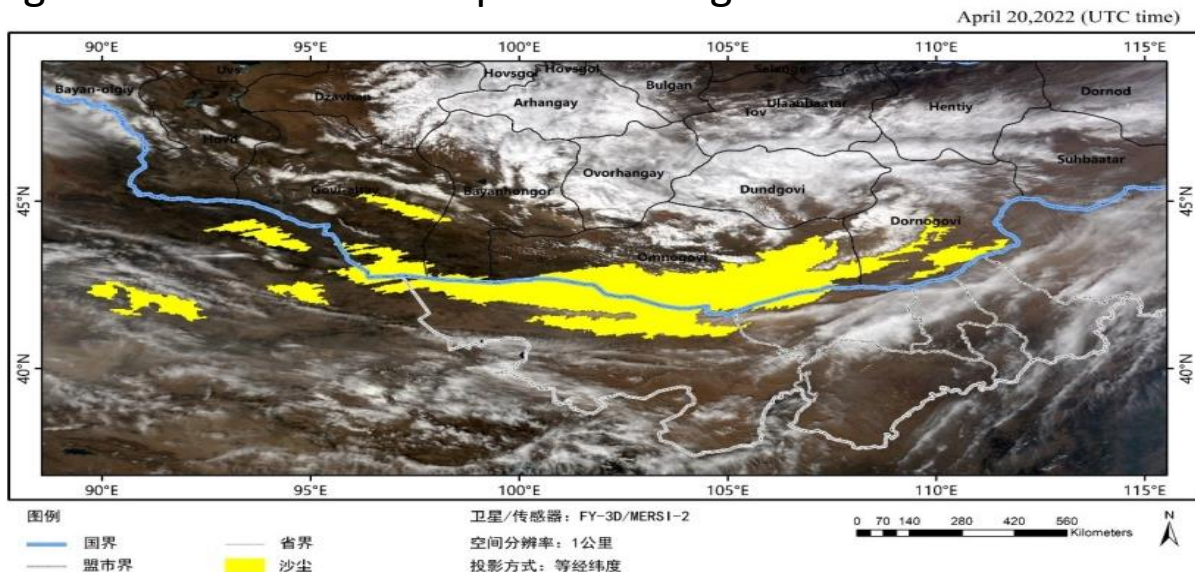
- Fengyun Meteorological Satellite monitored 8 large-scale dust storms on the Mongolian Plateau in 2023, significantly higher than the same period in previous years;
- This relates to land surface and weather conditions.



Applications: Weather Monitoring

The Dust Storm Monitoring over Mongolian Plateau

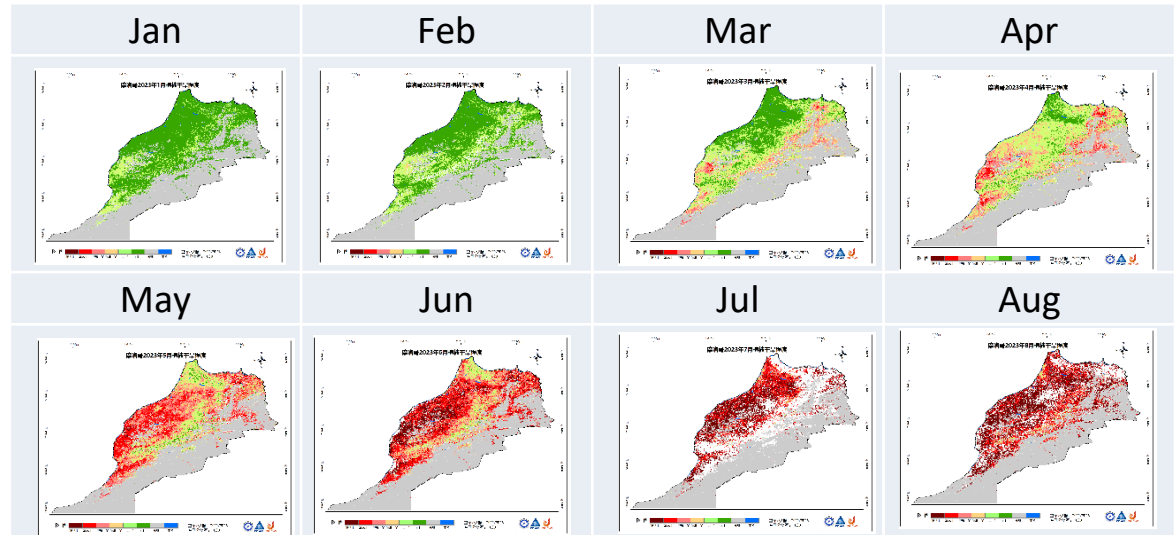
- The results of remote sensing by **FY-3D satellite** received in the afternoon of April 20, 2022 showed that there was a widespread dust weather process in the western of Inner Mongolia and the southern part of Mongolia.



Applications: Climate Monitoring

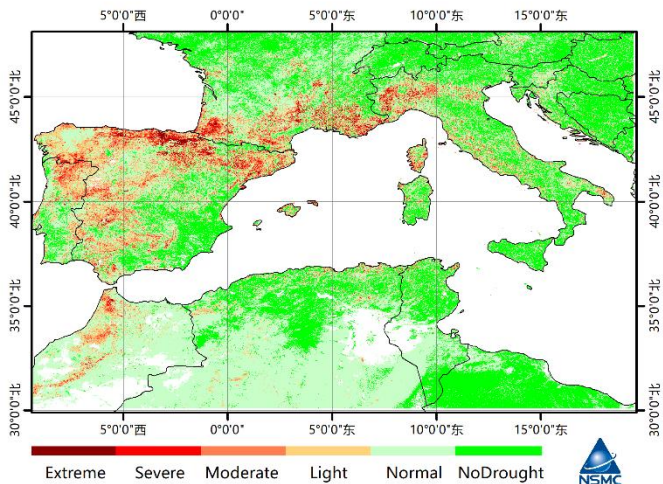
Using **FY-3D/MERSI data** to generate a **drought index monitoring map** from January August in 2023, it can be seen that the vegetation health level was the best in January. After March, vegetation growth began to deteriorate and drought began to spread from southern Morocco to the entire region.

Drought Monitoring in Morocco



Global Agricultural Drought Map

Drought conditions in Europe



Drought Map for West Europe in **middle of June 2022**

Rhin



Danub

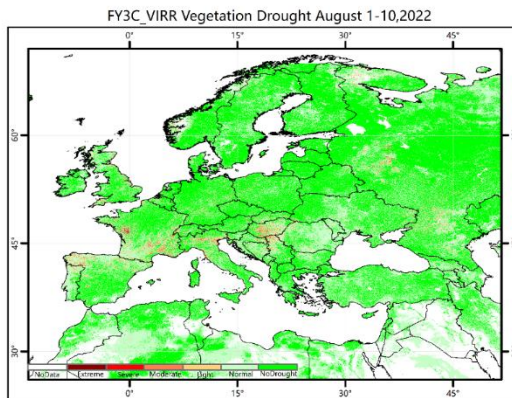
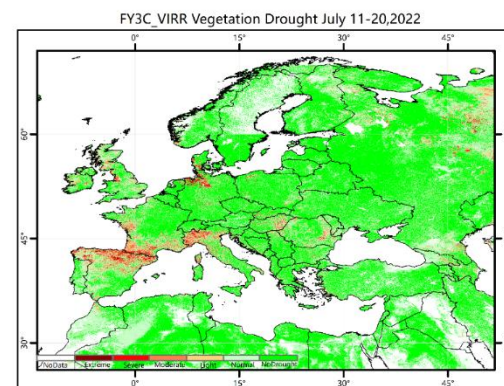
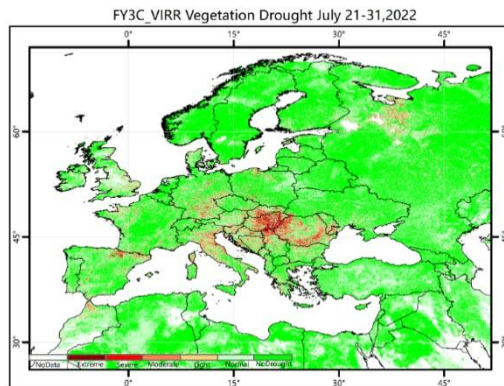
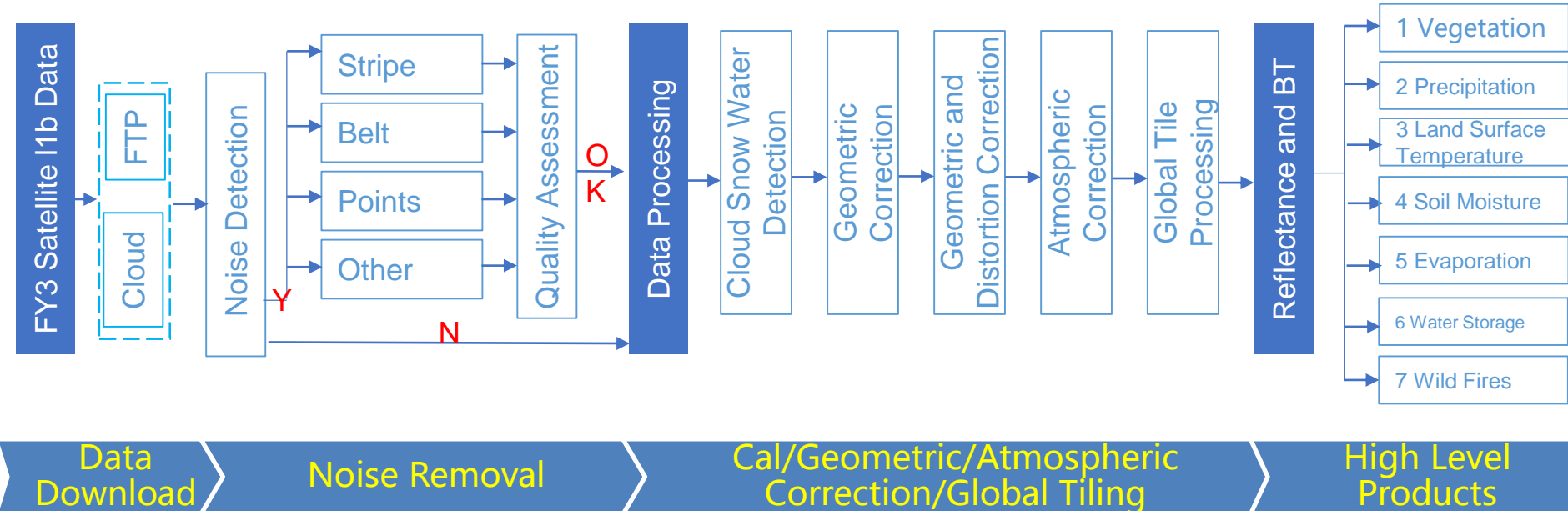


Figure 7: Low-Flow Index (LFI) at the end of June 2022. A Low-Flow Index of 0 corresponds to no drought and a value of 1 to the highest drought hazard.

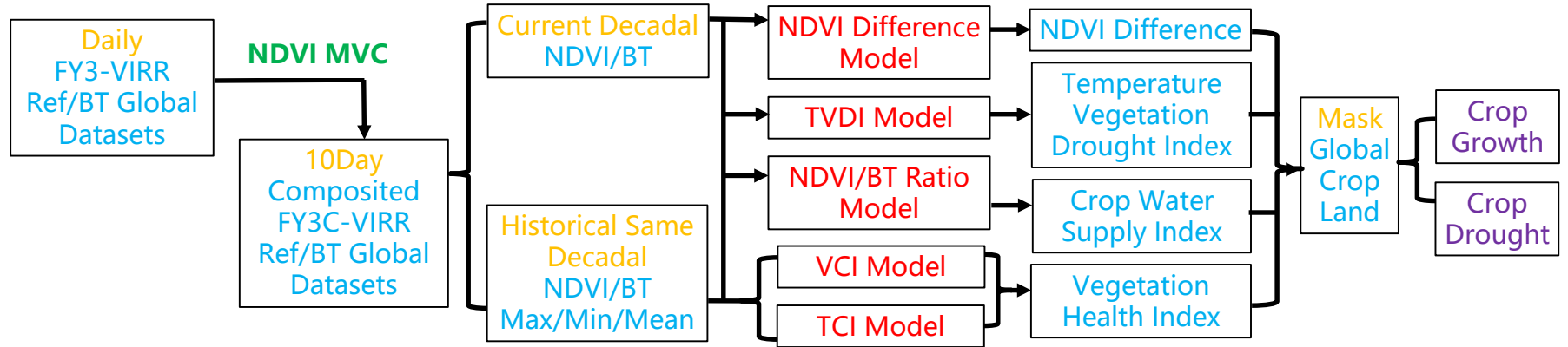
Drought Factors Monitoring

FY Satellite Data Processing for Drought Monitoring



Flowchart to retrieve the parameters for further applications

Drought Evaluation



Flowchart to develop the drought Evaluation indices

Drought Evaluation

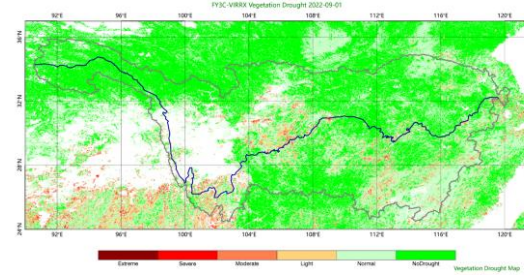
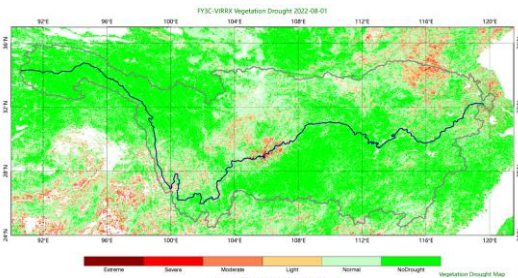
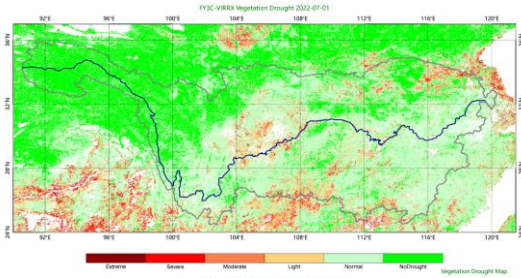
Drought conditions in China

Jul

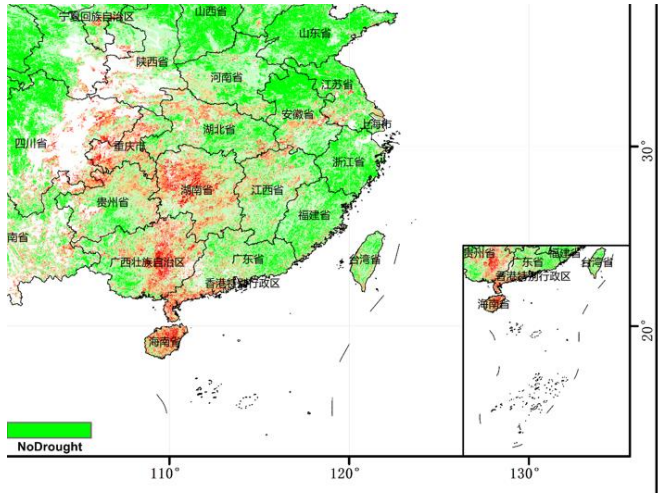
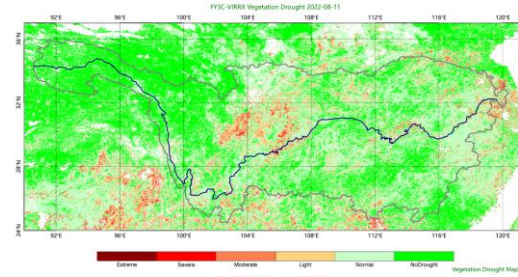
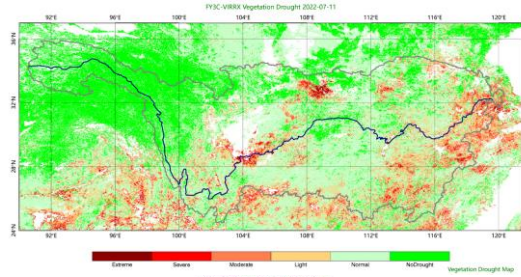
Aug

Sep

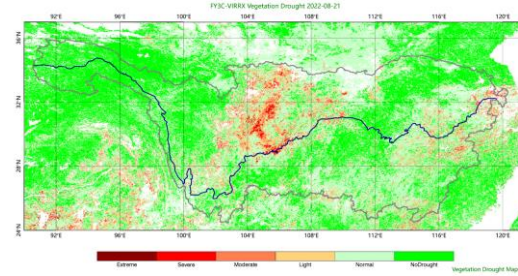
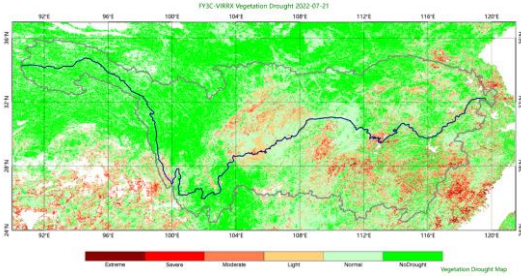
1st Dekadal



2nd Dekadal



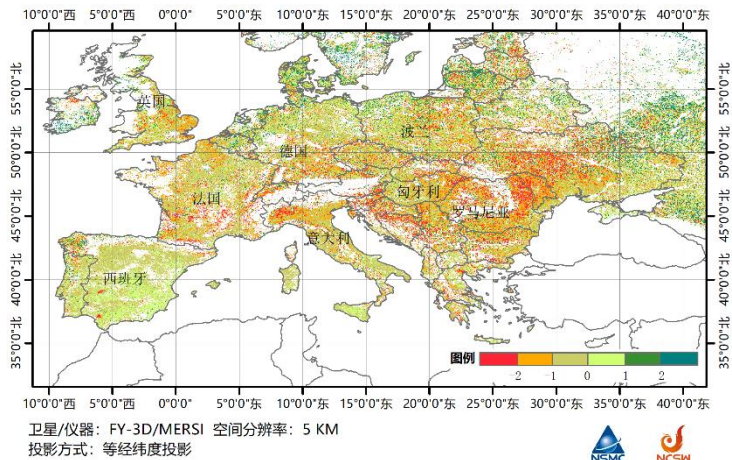
3rd Dekadal



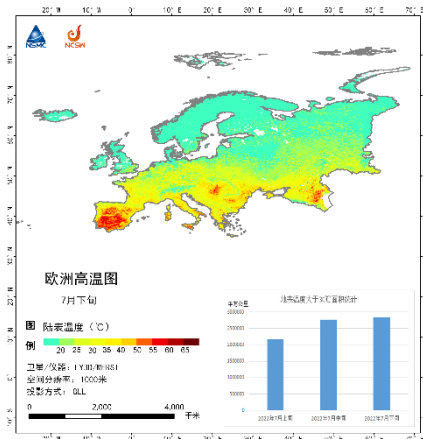
Applications: Environment Monitoring

Crop Growth in Europe

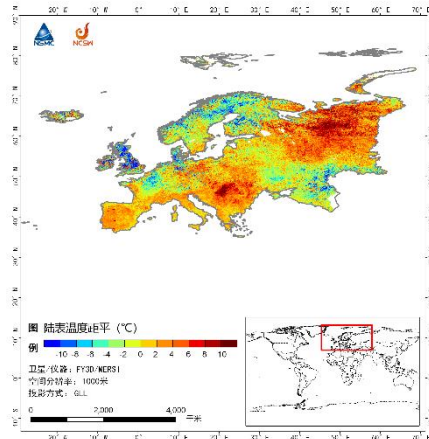
Since July 2022, the area of **surface high temperature** in Europe has continued to increase, and the high temperature and drought are affecting **the growth of crops** in Europe.



FY-3D leaf area index Image



FY-3D Surface Temperature Monitoring Map



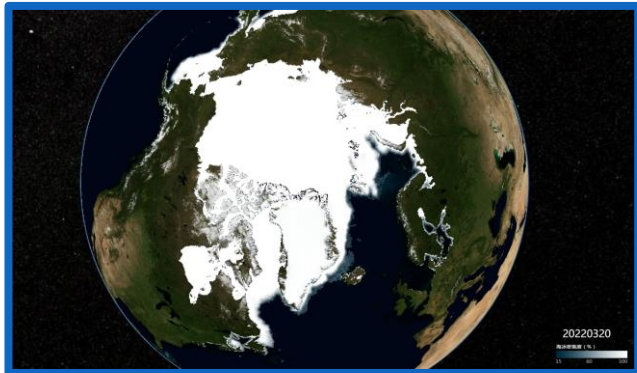
Applications: Climate Monitoring

Sea Ice Monitoring

- FengYun satellite the observation results shows sea ice extent in Antarctica **reached an minimum** in February, 2023.
- The Arctic is **warming more than twice** as fast as the global average warming.

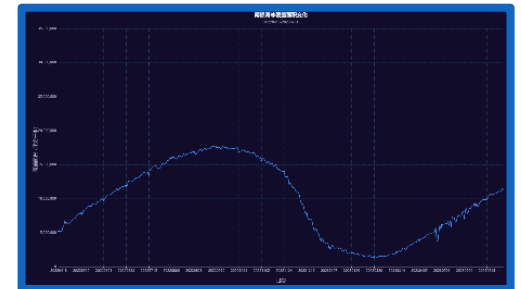
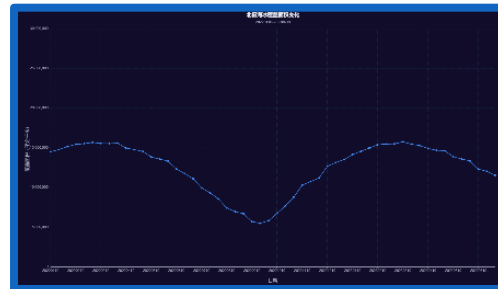
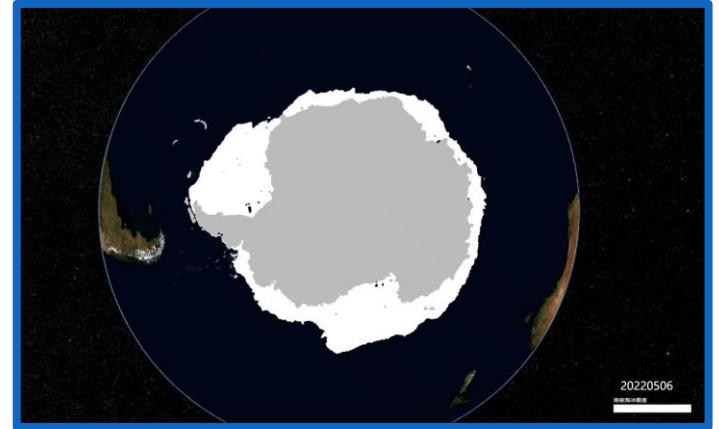
FY-3D/MWRI Arctic Ice

(202201-202306)

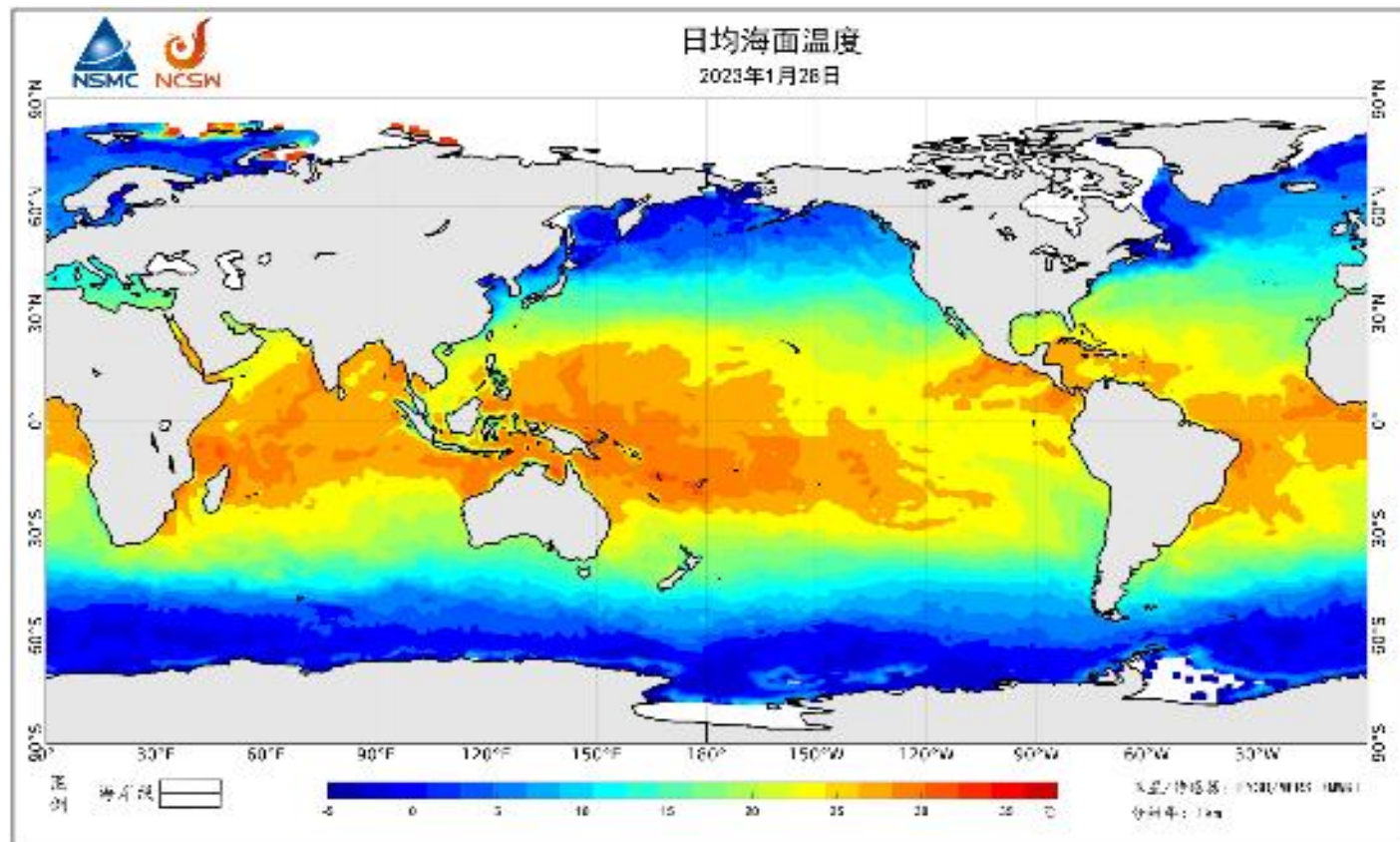


FY-3E/WindRAD Antarctic Ice

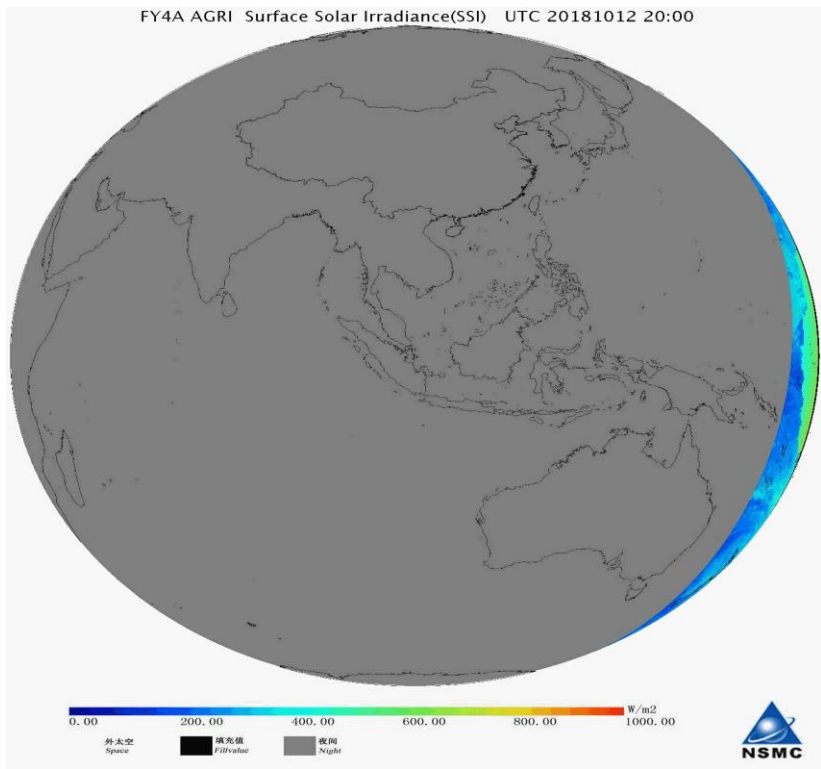
(20220506-20230601)



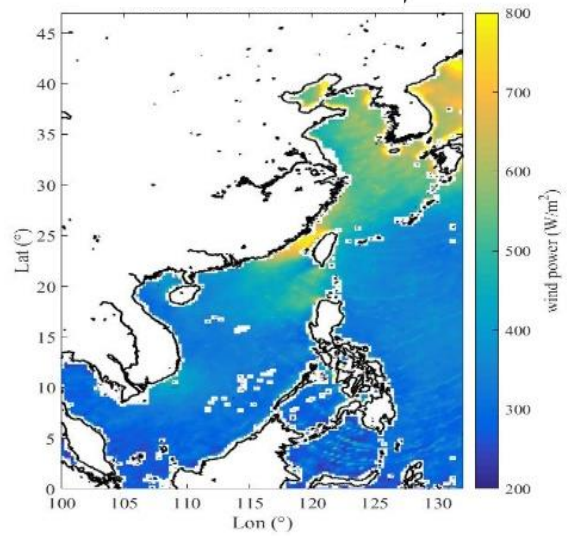
ENSO Analysis



Solar Energy

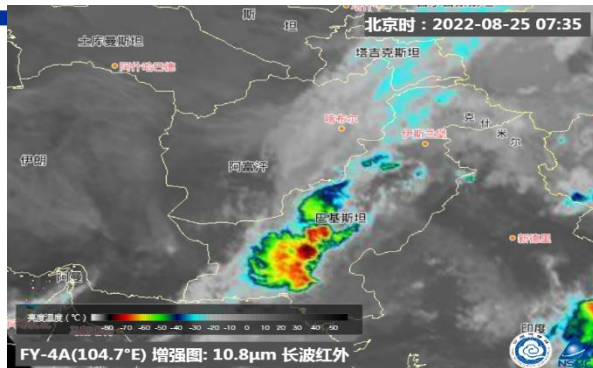


Wind Power

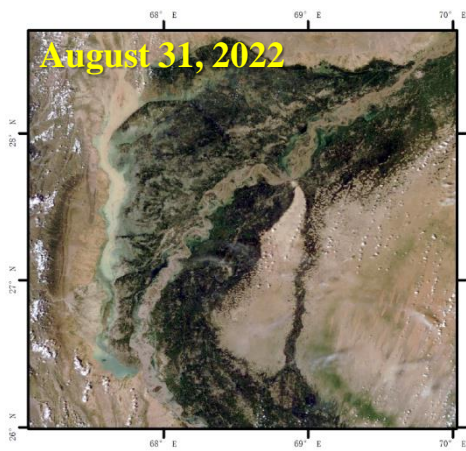
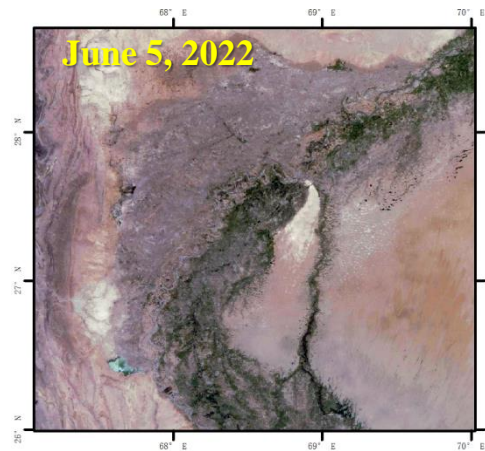


Applications: Natural Disaster

Pakistan has suffered heavy rainfall from the middle of June to September this year, Continuous rainstorm leads to flood disaster.

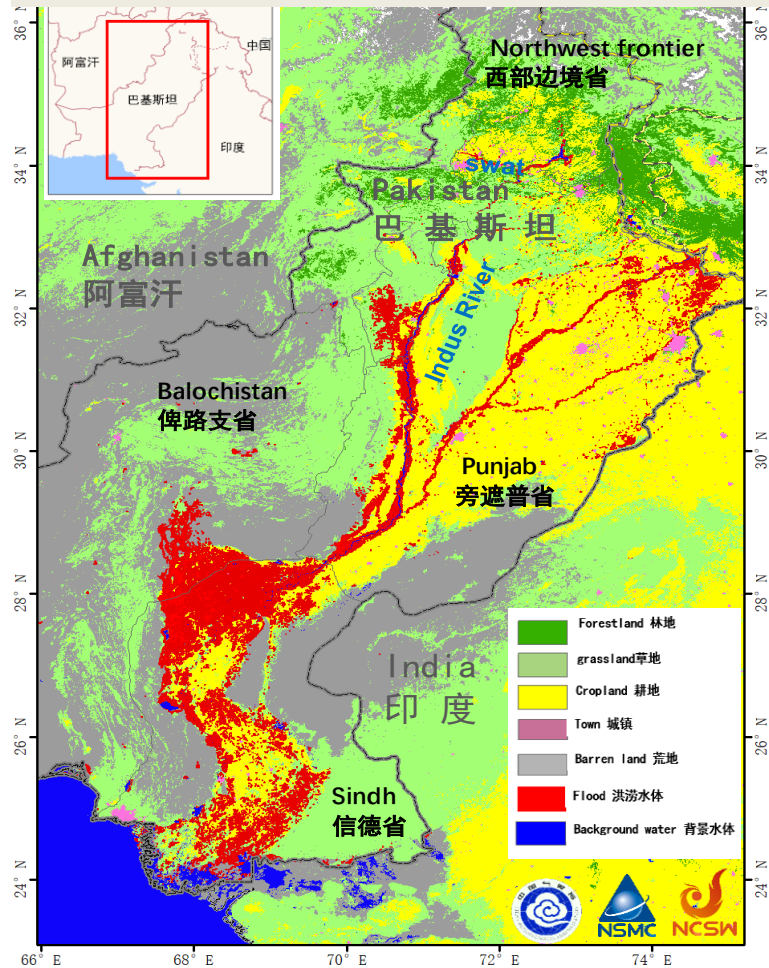


FY-4A Infrared Enhanced Image
2022-08-25 07:00

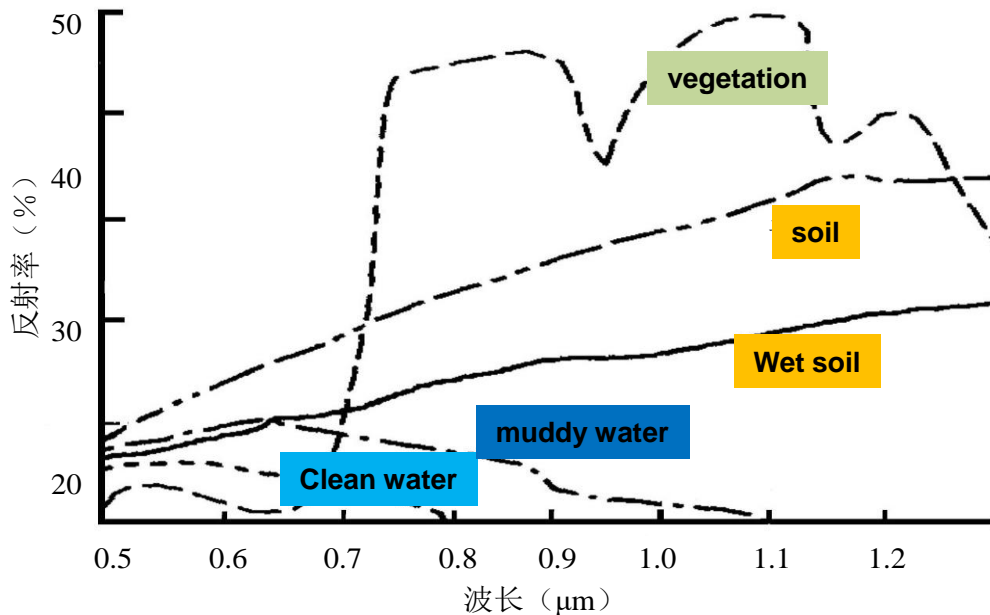


2022-06-05 vs 2022-08-31

Flood in Pakistan



Theory of flood monitoring by using optical satellite remote sensing data



Spectral characters of typical earth surface subjects

Water body identification is the base of flood monitoring. Water body has a strong absorption in near infrared channel, leading to a very low reflectance in this channel and a lower reflectance than in visible channel. On the contrary, vegetation and soil has a low reflectance in visible channel but a much higher reflectance in near infrared channel.

Surface water detection algorithm

1) Difference model:

$DI = NIR - RED$, and
 $NIR < A1, RED < A2, DVI < A3$

A1、A2、A3 :threshold value

2) Ratio model:

$RI = NIR / RED * k$, and

$NIR < A1, RED < A2, RVI < N$

N:threshold value, k:coefficient of amplification

3) NDVI model

$NDVI = (NIR - RED) / (NIR + RED) * k$, and

$NIR < A1, RED < A2, NDVI < N$

N:threshold value, k:coefficient of amplification

4) NDWI model

$NDWI = (Green - NIR) / (Green + NIR)$

Disadvantage: soil and building

5) Modified NDWI model

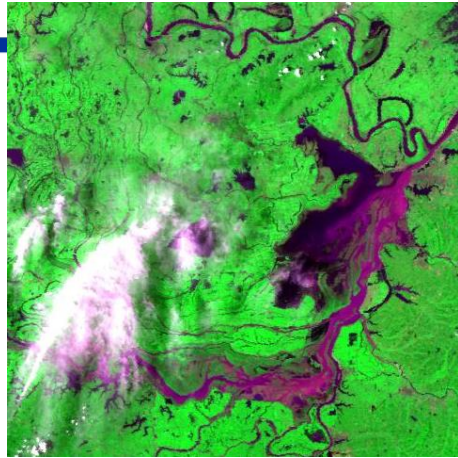
$MNDWI = (Green - MIR) / (Green + MIR)$

Disadvantage: shadow and residential areas

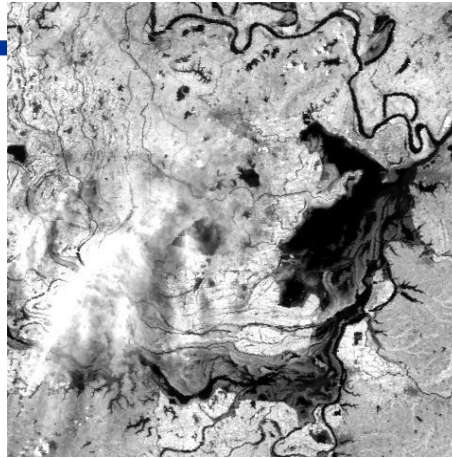
FY-3D/MERSI-II

No.	Center wavelength	Bandwidth	Spatial Resolution
1	412 nm	20 nm	1000 m
2	443 nm	20 nm	1000 m
3	470 nm	50 nm	250 m
4	490 nm	20 nm	1000 m
5	550 nm	50 nm	250 m
6	555 nm	20 nm	1000 m
7	650 nm	50 nm	250 m
8	670 nm	20 nm	1000 m
9	709 nm	20 nm	1000 m
10	746 nm	20 nm	1000 m
11	865 nm	20 nm	1000 m
12	865 nm	50 nm	250 m
13	905 nm	20 nm	1000 m
14	936 nm	20 nm	1000 m
15	940 nm	50 nm	1000 m
16	1240 / 1030 nm	20 nm	1000 m
17	1380 nm	20 / 30 nm	1000 m
18	1640 nm	50 nm	1000 m
19	2130 nm	50 nm	1000 m
20	3.80 μ m	0.18 μ m	1000 m
21	4.05 μ m	0.155 μ m	1000 m
22	7.20 μ m	0.50 μ m	1000 m
23	8.55 μ m	0.30 μ m	1000 m
24	10.8 μ m	1.0 μ m	250 m
25	12.0 μ m	1.0 μ m	250 m

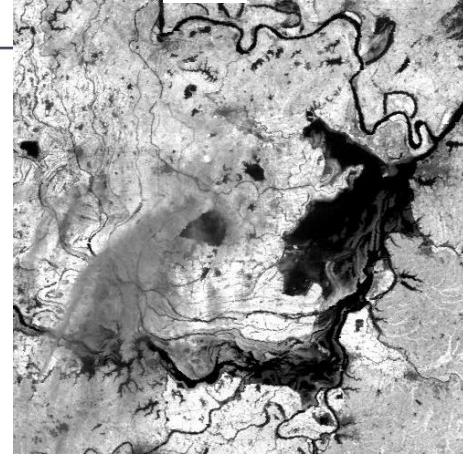
3、 4、 2 composite image



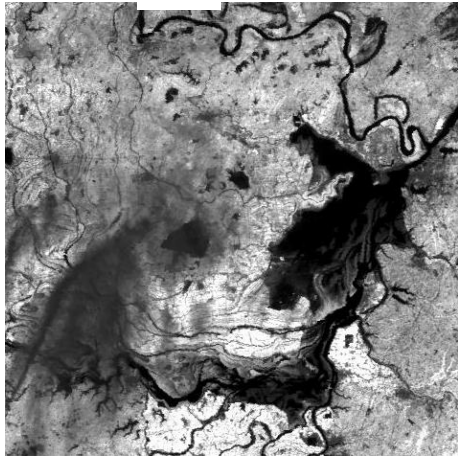
Single band



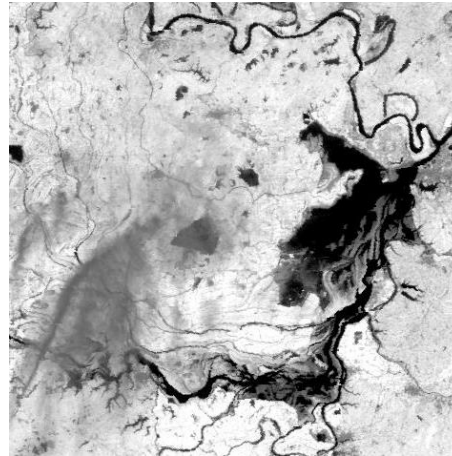
DI



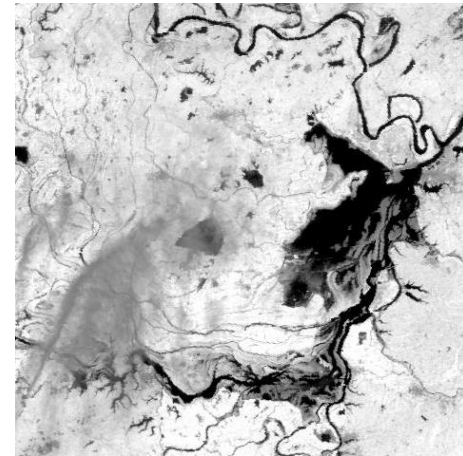
RI



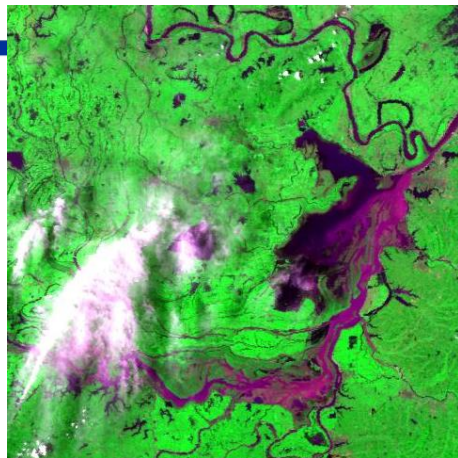
NDVI



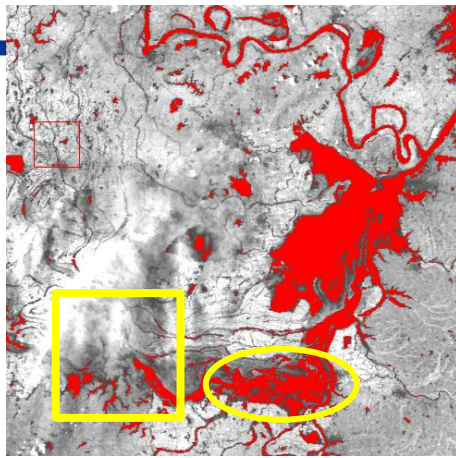
NDWI



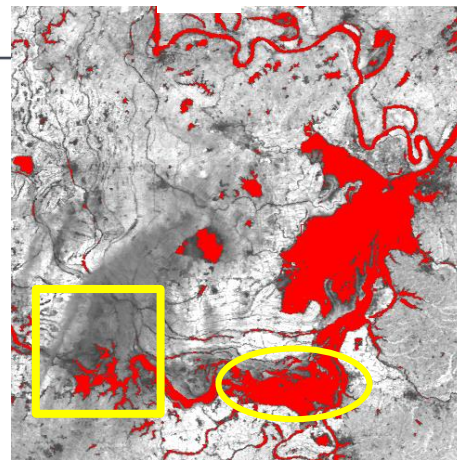
3、4、2 composite image



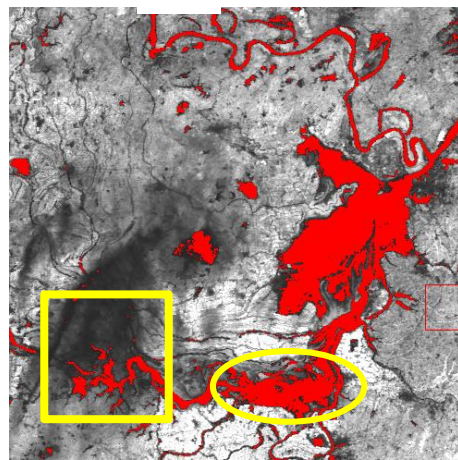
Single band



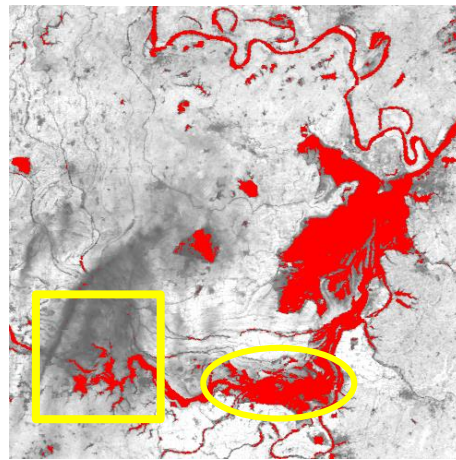
DI



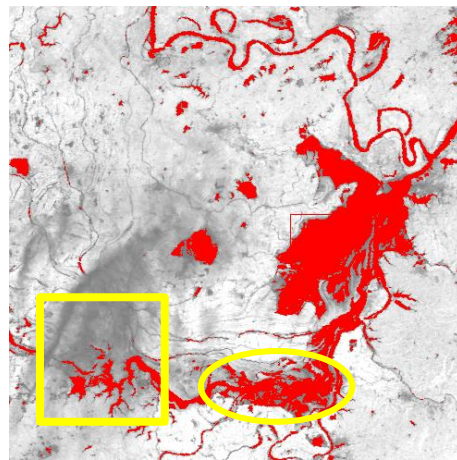
RI



NDVI

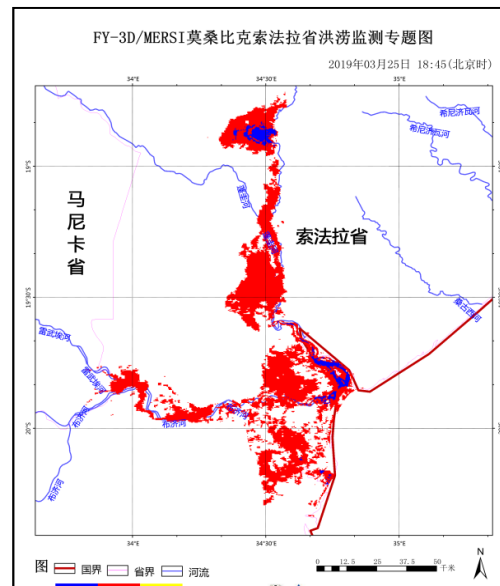
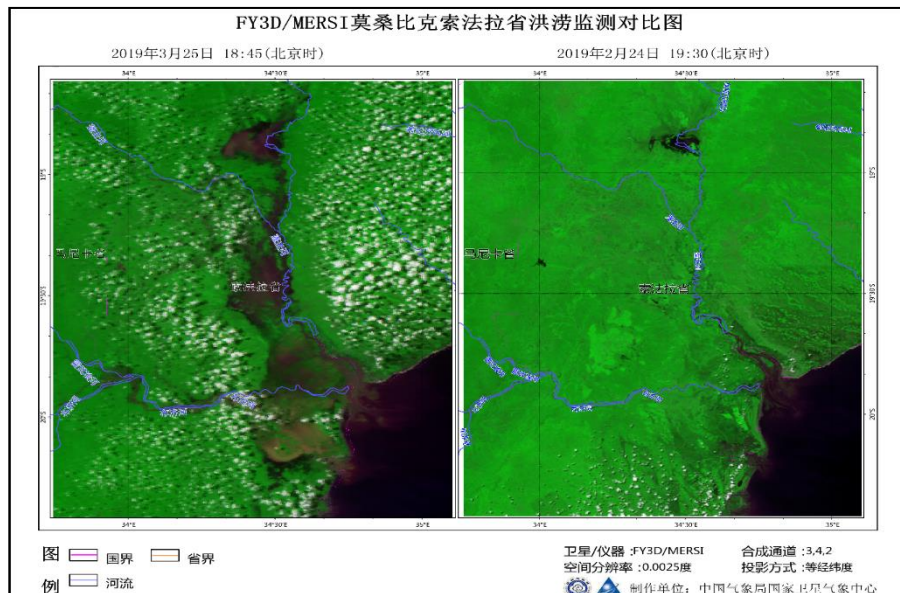


NDWI



Monitoring flood based on FY satellites data

When the severe flood happened in China, One Belt And One Road region and other countries, the FY satellite data will be tried to detect flood. The flood mapping products will be provided to relative countries .

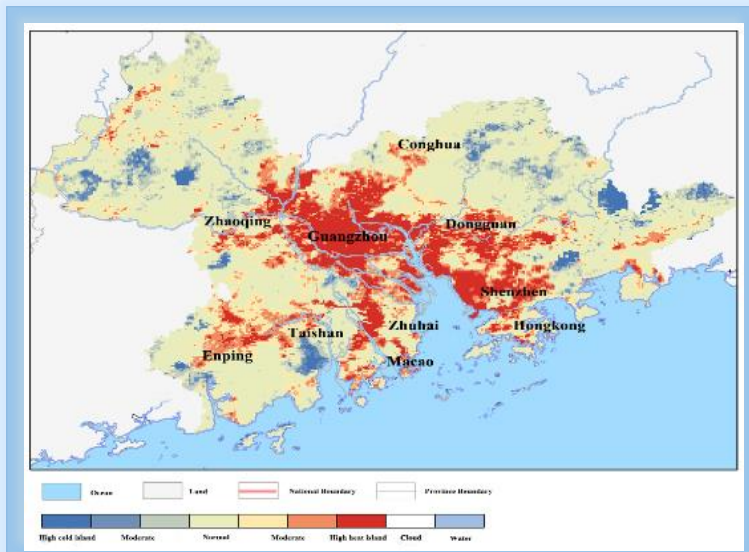


On the evening of March 14, super typhoon Idai landed on the central coast of Mozambique, causing extensive flooding in central Mozambique.

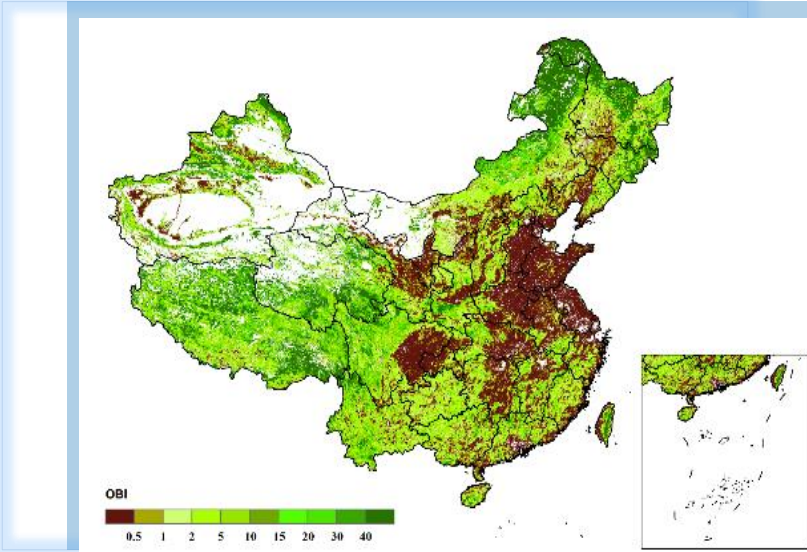
The flood mapping based on FY-3D satellite on showed that a large number of new water bodies appeared in the the Penggui and Niyandukai rivers

Applications: Environment Monitoring

Urban Heat Island



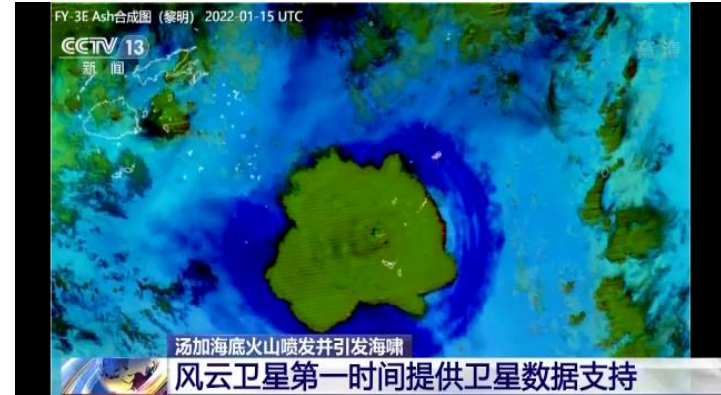
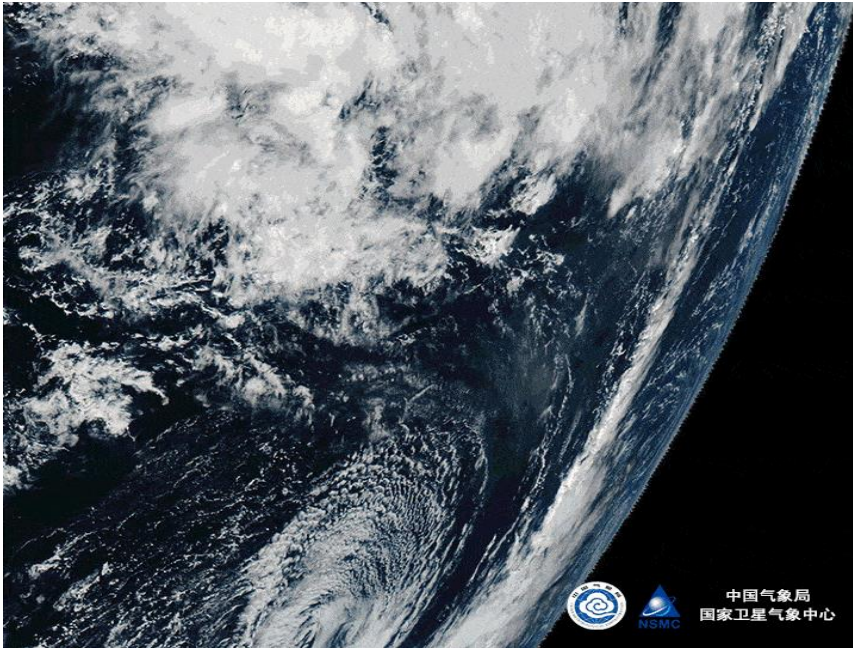
Oxygen Balance



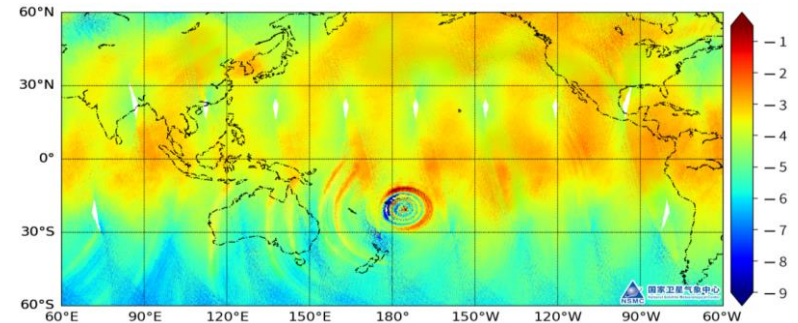
Applications: Natural Disaster

The Volcano Eruption Monitoring over Tonga

- The FengYun satellite have **observed volcano eruption**, we also provide **volcanic ash transmission** and **atmospheric gravity waves** monitoring services.



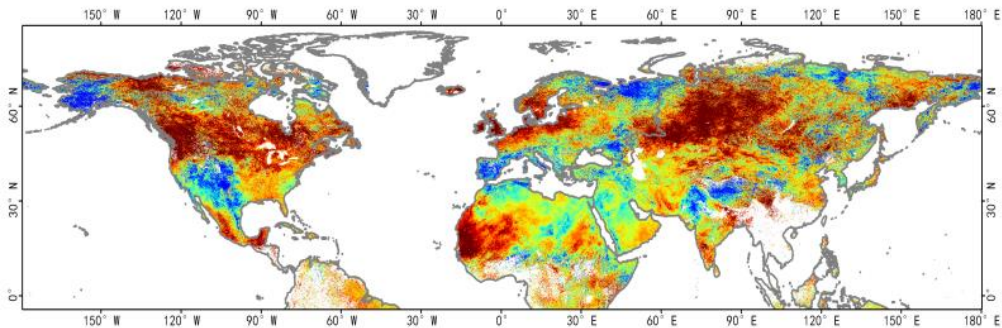
FY-3E volcanic ash and shock wave monitoring



Applications: Environment Monitoring

Heat wave Monitoring

- FY-3D satellite monitoring results shows that since June, the **temperature** in the northern hemisphere has been **generally higher than the average temperature** of the same period last year, and that **caused wild fires** in many parts of North America and Eurasia.

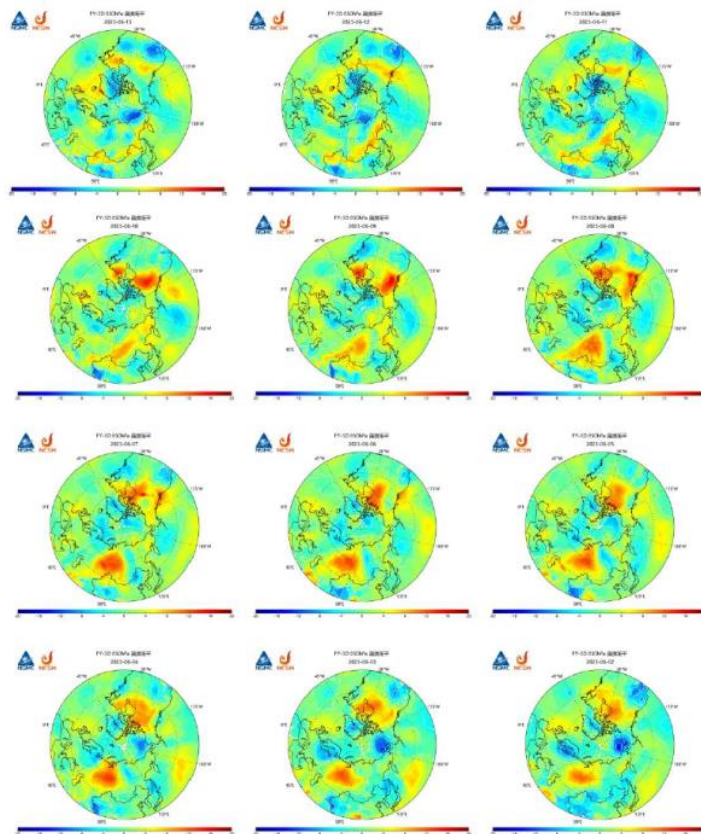


Land Surface Temperature
Map of the Northern
Hemisphere
June 1-13, 2023

图 陆表温度距平 (°C)



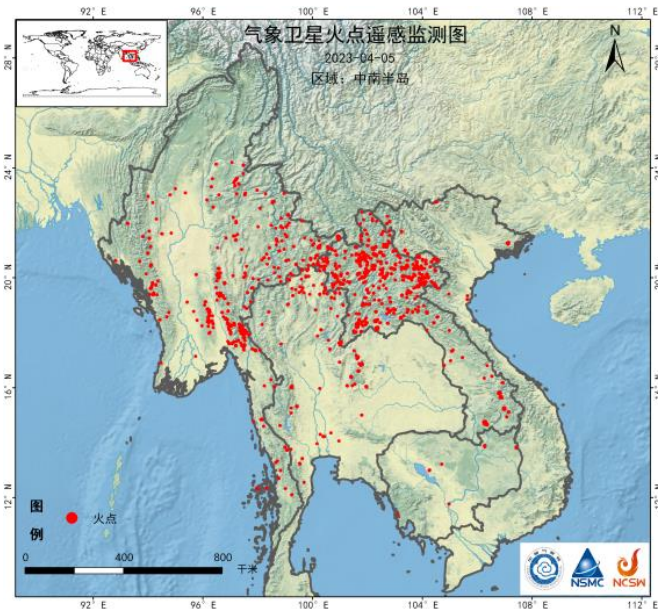
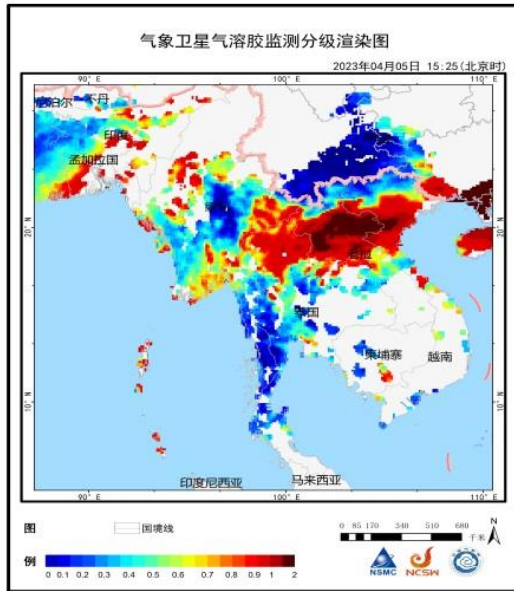
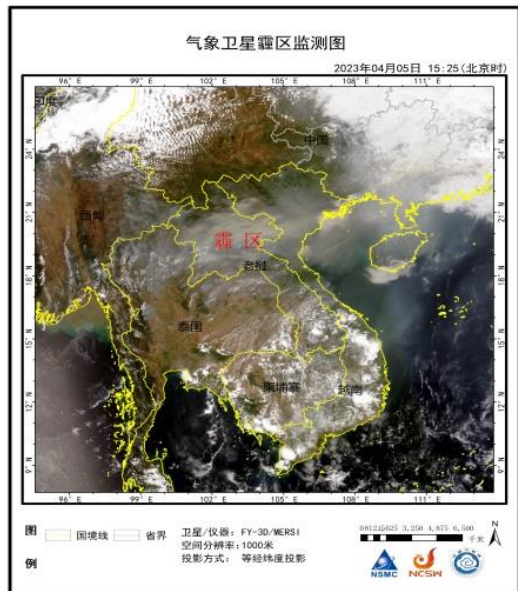
例
卫星/仪器: FY3D/MERSI
空间分辨率: 1000米
投影方式: GLL



Applications: Environment Monitoring

The Haze Monitoring in Southeast Asia

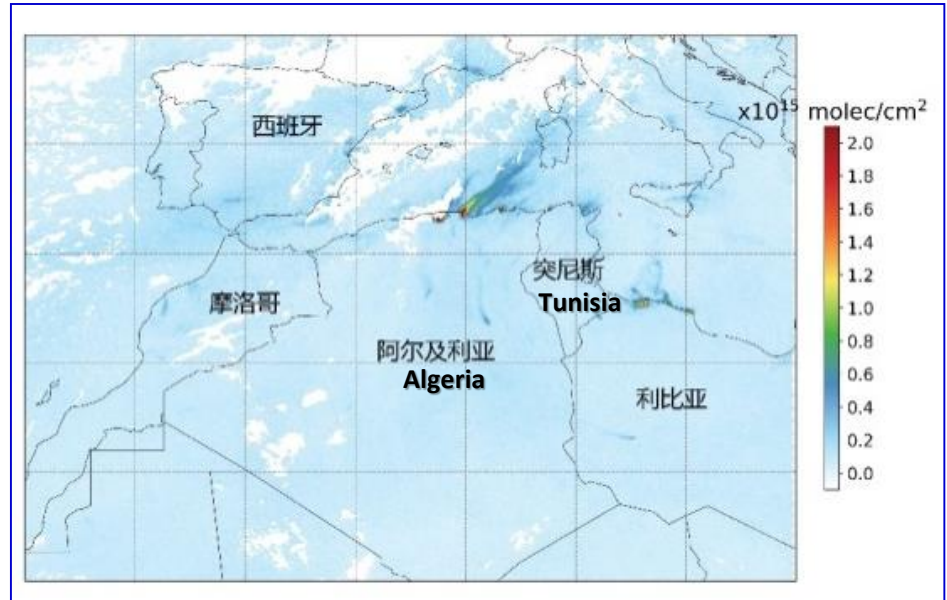
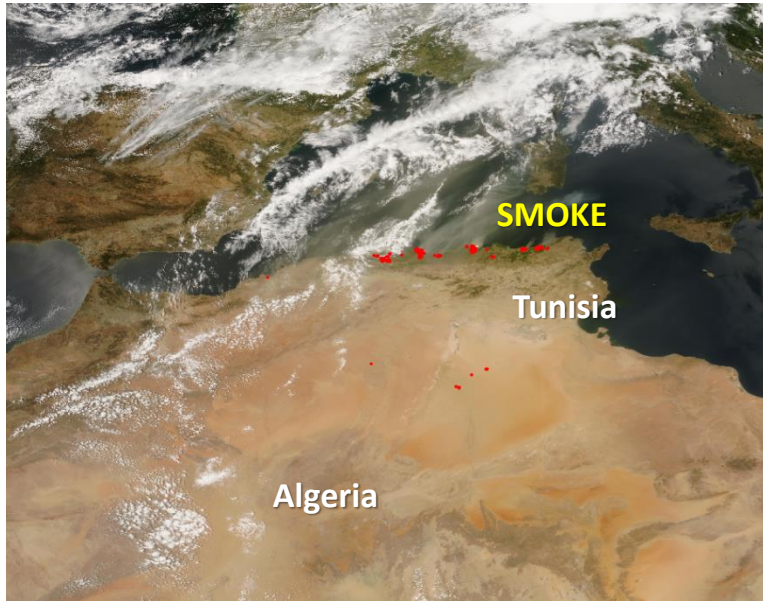
- FY-3D satellite monitored the serious haze caused by the continuous biomass burning, the haze smoke were mainly appeared in northern Laos, in early April, 2023.



Applications: Natural Disaster

Wild Fire Monitoring in Algeria and Tunisia

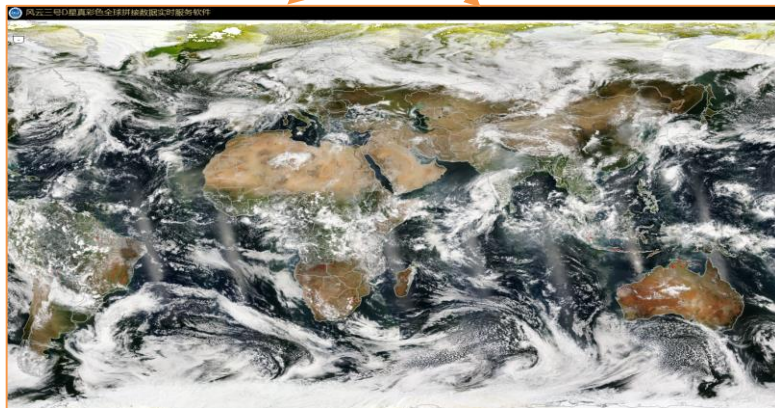
FY-3D made close monitor of dense fires along the coast of Algeria, extended into northwestern Tunisia.



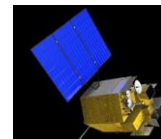
Current wildfire monitoring capability



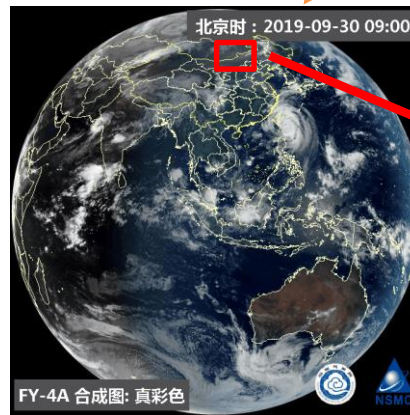
FY-3D,E,F



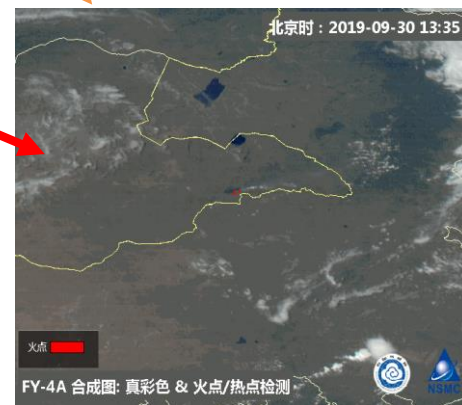
250-m spatial resolution at global scale



FY-4A,B



24-hour continuous dynamic monitoring

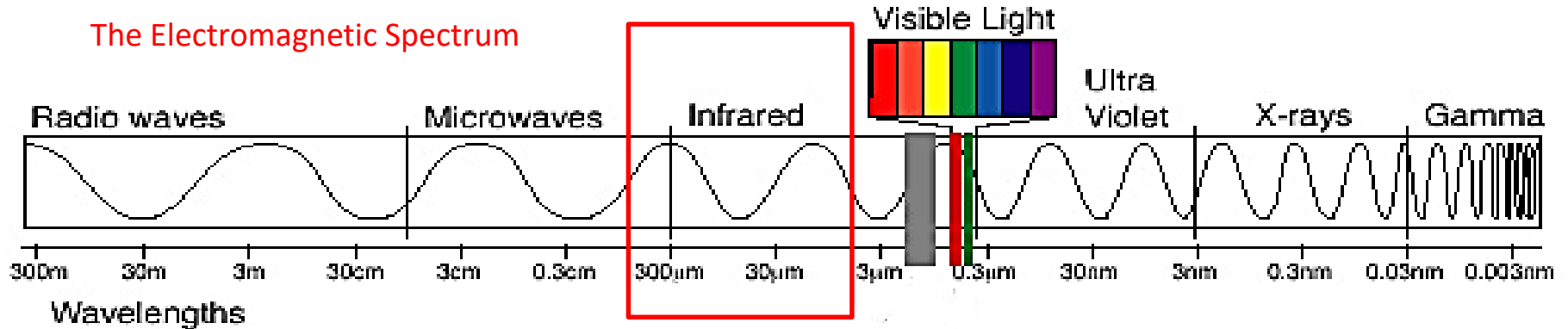


FY-3 and FY-4 as the second generation of Chinese meteorological satellite, the spatial, temporal and spectral resolution improved largely. The fire monitoring capability has been enhanced greatly. More accurate and timely fire products can be generated. Especially in global application, FY become the most important data in NSMC.

- ✓ **High response time**
- ✓ **High positioning accuracy**
- ✓ **High monitoring frequency**

The method of wildfire detection

Theory and method for wildfire detection



- Remote sensing uses the radiant energy that is reflected and emitted from Earth at various “wavelengths” of the electromagnetic spectrum;
- The satellite infrared channel is very sensitive to the hotspots on the earth.

The method of wildfire detection

Planck's Radiation Law describes the amount of emitted energy per wavelength depending on the objects temperature:

$$M_{\lambda,T} = \frac{C_1}{\lambda^5 \left[e^{\left(\frac{C_2}{\lambda T}\right)} - 1 \right]},$$

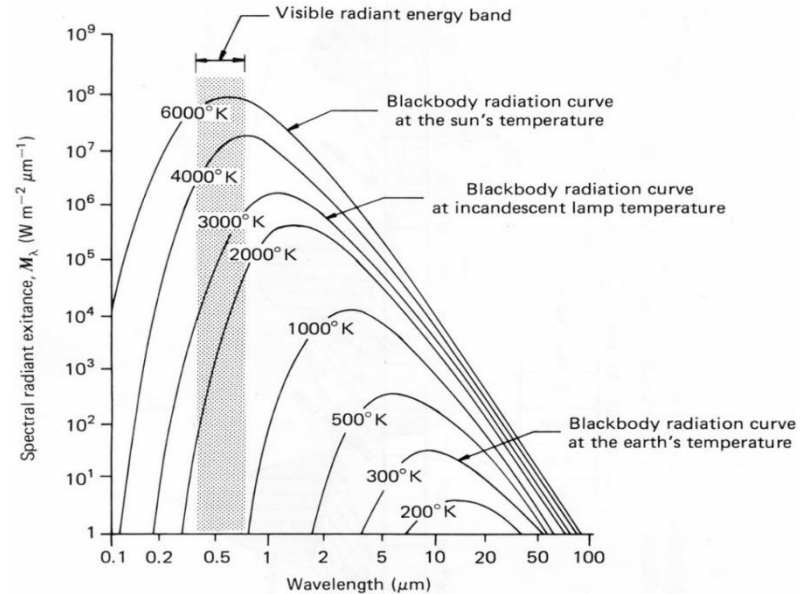
where $M_{\lambda,T}$ is the spectral radiant emittance in (W m^{-3}), λ is the wavelength in (m), T is the absolute temperature in (K), C_1 is the first radiation constant, $3.74151 \cdot 10^{-16}$ (W m^2) and C_2 is the second radiation constant, 0.01438377 (mK).

For very hot surfaces (e.g. the sun), the peak of the blackbody curve is at short wavelengths. For colder surfaces, such as the earth, the peak of the blackbody curve moves to longer wavelengths.

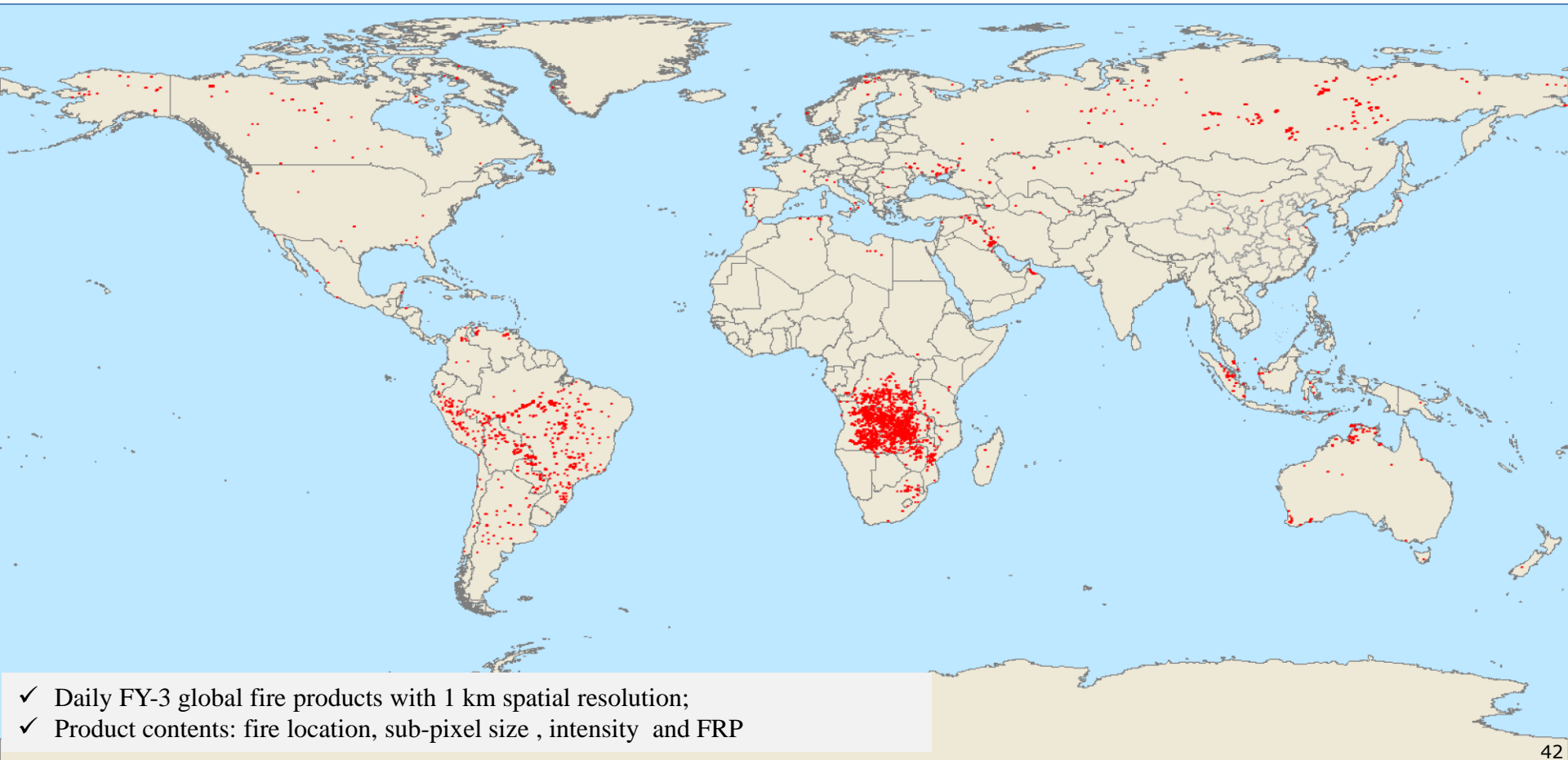
This behavior described by Wien's displacement law

$$\lambda_{max} = \frac{2898}{T}$$

where λ_{max} is the wavelength of the radiation maximum in (μm), T is temperature in (K) and 2898 is a physical constant in (μm).

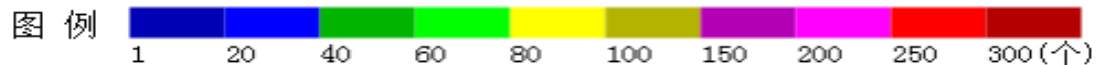
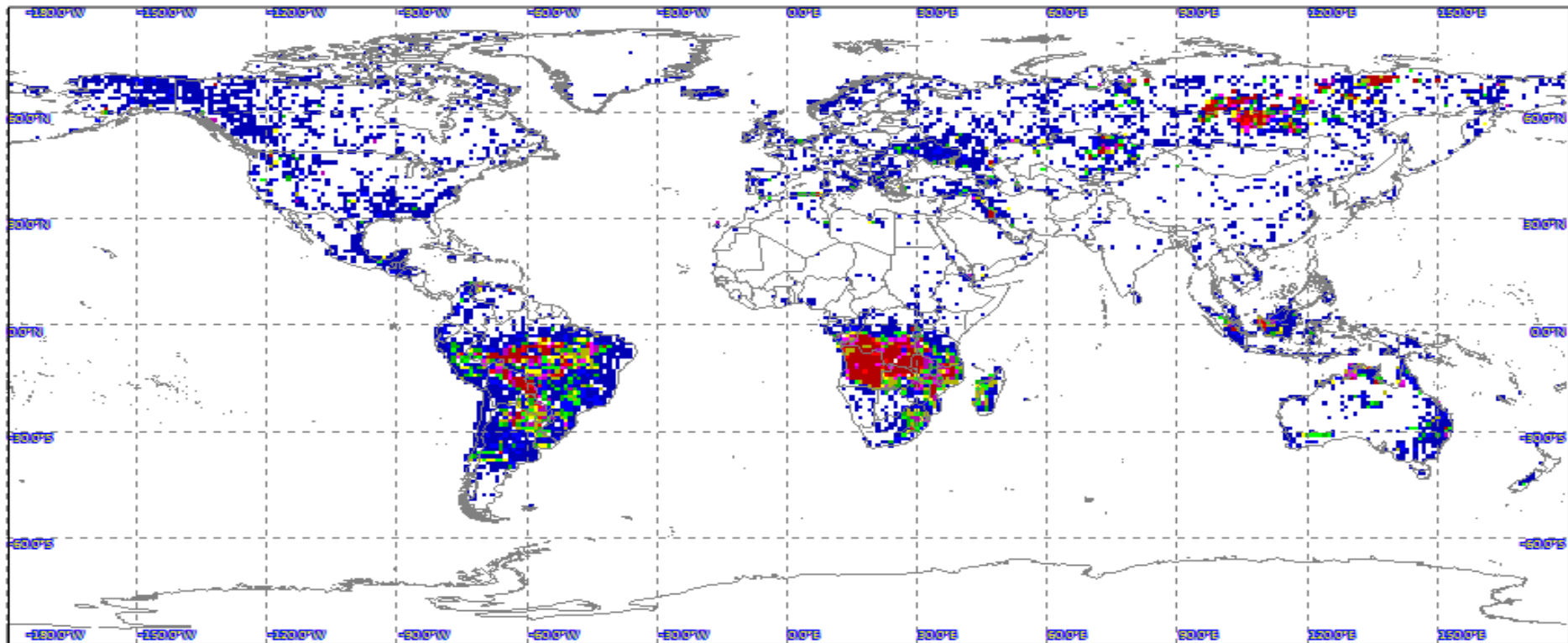


Daily global wildfire product of FY-3D (On 21 August, 2019)



- ✓ Daily FY-3 global fire products with 1 km spatial resolution;
- ✓ Product contents: fire location, sub-pixel size, intensity, and FRP

Monthly global wildfire accumulation product using FY-3D (In August,2019)

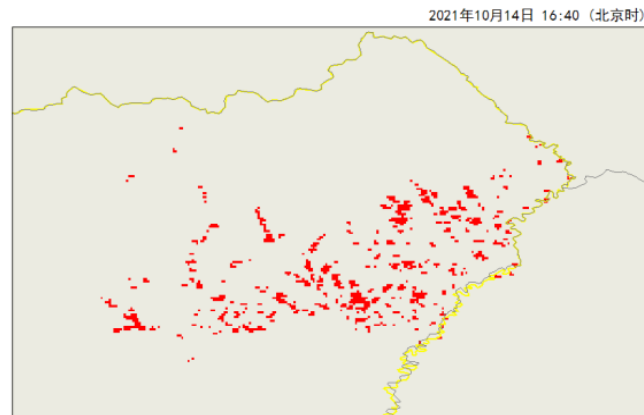
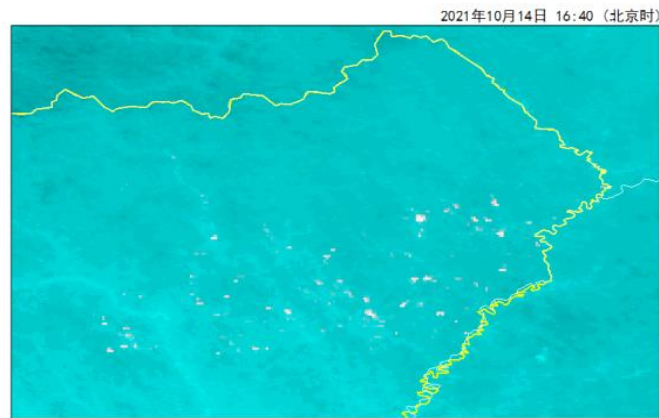
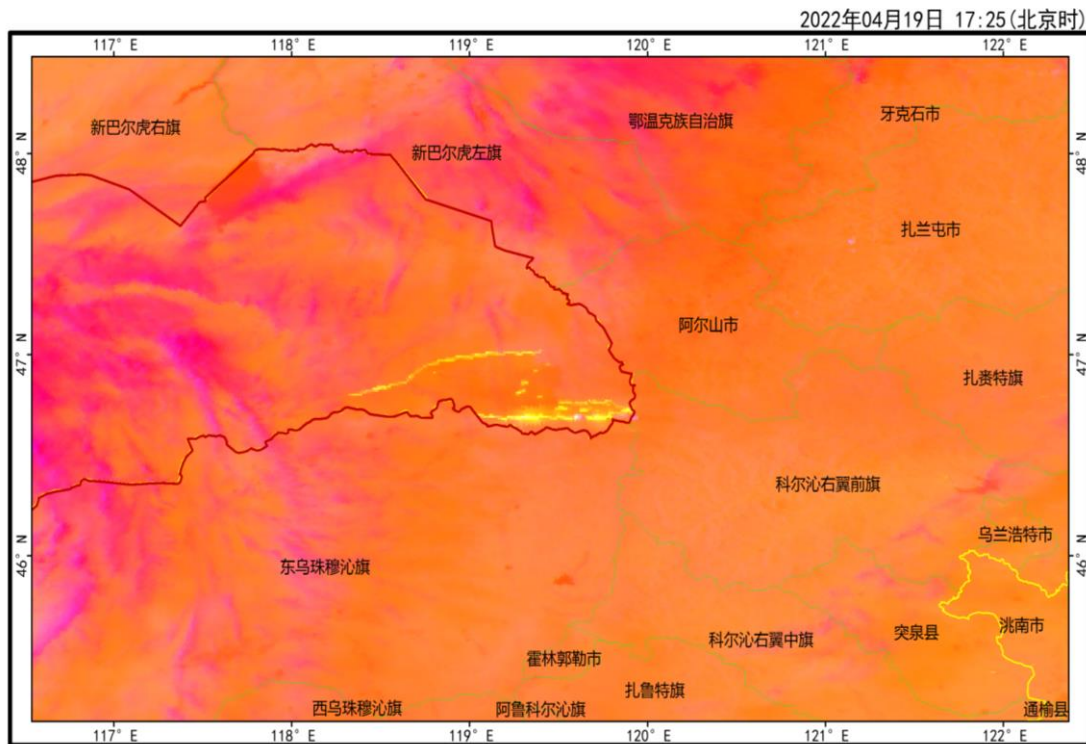


中国气象局



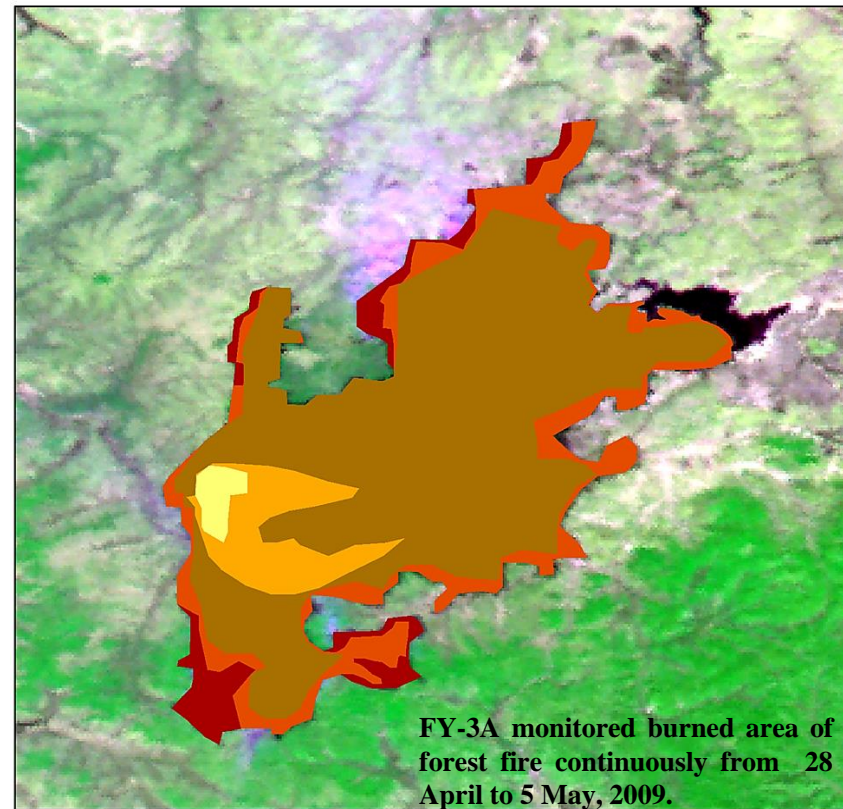
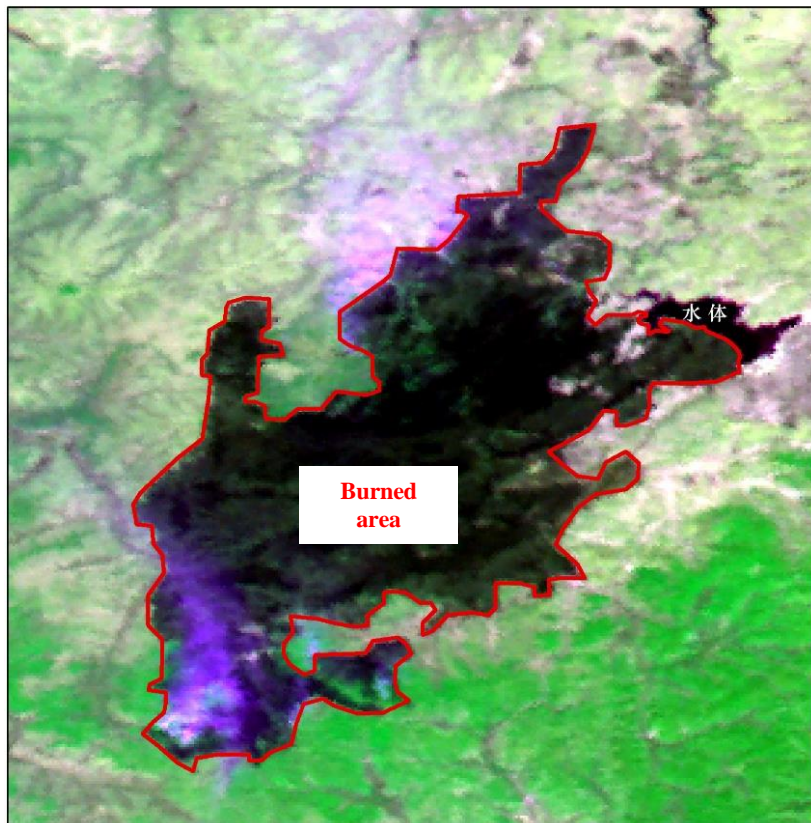
国家卫星气象中心

FY-3E Early Morning satellite fire monitoring

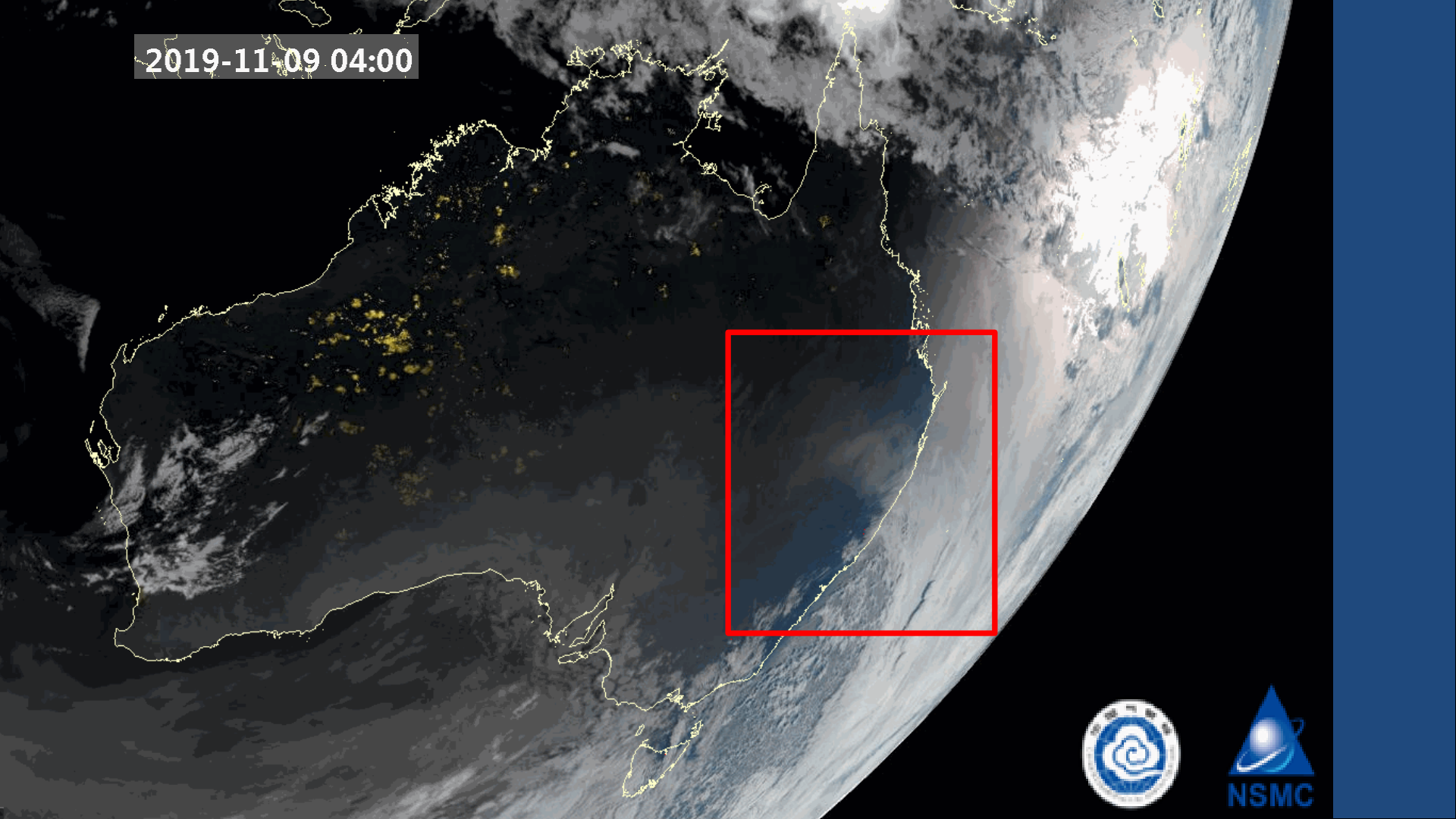


Burned area estimation based on FY data

FY-3A monitored burned area of forest fire in the northeast of China
5 May, 2009



2019-11-09 04:00



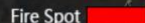
<http://rsapp.nsmc.org.cn/geofy/en>

UTC:2019-11-09 07:00

The image shows a satellite view of a wildfire. A yellow line traces the fire's perimeter, and several red dots indicate hot spots. A semi-transparent menu titled 'Satellite products' is overlaid on the right side of the image. The 'Fire Hot Spot' option is selected and circled in red. A legend in the bottom-left corner shows a red bar next to the text 'Fire Spot'. The background is a satellite image of a landscape with a large body of water.

Satellite products

- Lighting Frequency (One hour)
- Quantitative Precipitation Estimate
- Sea Surface Temperature
- Dust Storm Detection
- Fire Hot Spot
- Upper-Level Water Vapor Atmospheric Motion Vectors
- Cloud Mask
- Cloud Phase
- Cloud Type
- Cloud Top Height
- Cloud Top Pressure
- Cloud Top Temperature
- Lower-Level Water Vapor Atmospheric Motion Vectors
- Infrared Atmospheric Motion Vectors
- Land Surface Emissivity
- Reflected Shortwave Radiation
- Outgoing Longwave Radiation
- Upward Longwave Radiation
- Downward Longwave Radiation
- Total Precipitable Water
- Tropopause Folding
- Temperature (500hPa)
- Temperature (700hPa)
- Temperature (850hPa)
- Temperature (1000hPa)

Fire Spot 

FY-4A(104.7°E) True Color & Fire Hot Spot

NSMC

Wildfire product tools

FENGYUN satellite data center

<http://satellite.nsmc.org.cn/PortalSite/Default.aspx>

FENGYUN Satellite Data Center

NATIONAL SATELLITE METEOROLOGICAL CENTER

Home > Data > Data View

LEO TANSAT GEO

You have select: Land Global Fire Spot Monitoring(GFR) FY-3D Daily FY-3C FY-3B

<input type="checkbox"/> Satellite	<input checked="" type="checkbox"/> FY-3D	<input checked="" type="checkbox"/> FY-3C	<input checked="" type="checkbox"/> FY-3B	<input type="checkbox"/> FY-3A
	<input type="checkbox"/> FY-1D	<input type="checkbox"/> NOAA-18	<input type="checkbox"/> NOAA-17	<input type="checkbox"/> NOAA-16
<input type="checkbox"/> Product	<input type="checkbox"/> L1 DATA	<input type="checkbox"/> Image	<input type="checkbox"/> Atmosphere	<input checked="" type="checkbox"/> Land
	<input type="checkbox"/> Ocean	<input type="checkbox"/> Radiation		
<input type="checkbox"/> Instrument	<input type="checkbox"/> Global Navigation Satellite System	<input type="checkbox"/> MicroWave Temperature	<input type="checkbox"/> MicroWave Humidity Sounder(MWHS)	
	<input type="checkbox"/> IPM(IPM)	<input type="checkbox"/> HIRAS(HIRAS)	<input type="checkbox"/> TSHS(TSHS) ...	
<input type="checkbox"/> Catalog	<input checked="" type="checkbox"/> Global Fire Spot	<input type="checkbox"/> Land Surface	<input type="checkbox"/> Land Surface	<input type="checkbox"/> Vegetation Index(NVI)
	<input type="checkbox"/> Snow Cover(SNC)	<input type="checkbox"/> Snow cover Fraction(SNF)	<input type="checkbox"/> Snow Water Equivalent(SWE)	<input type="checkbox"/> Soil Moisture(VSM)
<input type="checkbox"/> Period	<input type="checkbox"/> Orbit	<input checked="" type="checkbox"/> Daily	<input type="checkbox"/> 5 Days	<input type="checkbox"/> 10 Days
	<input type="checkbox"/> Monthly			

	Product ▲	Satellite	Instrument	Period	Format	Resolution	Start Date	Last Date	File count	Volume(GB)	Availability	Operation	Quality Report
<input type="checkbox"/>	MERSI-II global fire spot monitoring	FY3D	MERSI	DAILY	HDF	1000M	2019-04-30	2019-11-09	511	0.11	View	Go	
<input type="checkbox"/>	VIRR GFR Daily	FY3B	VIRR	DAILY	HDF	1000M	2010-12-14	2019-11-09	3238	1.45	View	Go	

FY-3 daily fire products can be downloaded from FY satellite data center .

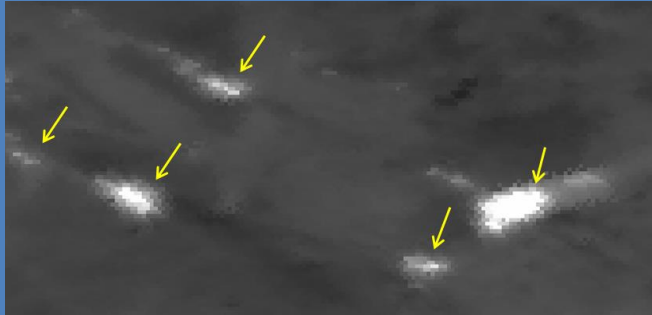
New method research for wildfire detection

Combining FY-3D/MERSI-II far-infrared and mid-infrared data

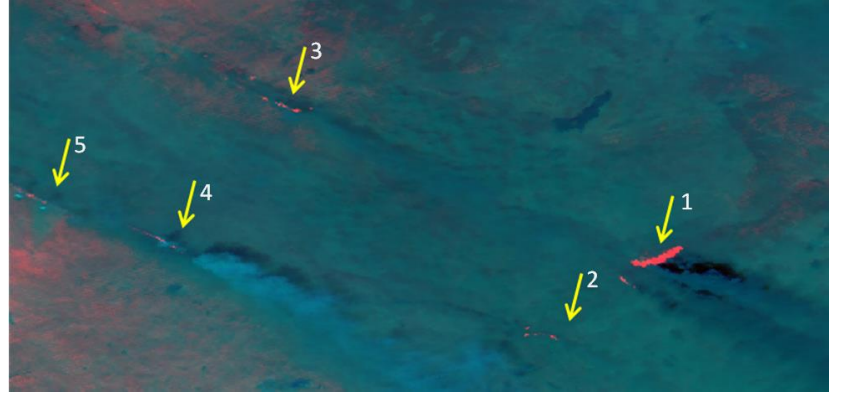
FY-3D/MERSI-II have 250m resolution in far-infrared channels, which can provide more accurate position and intensity information.



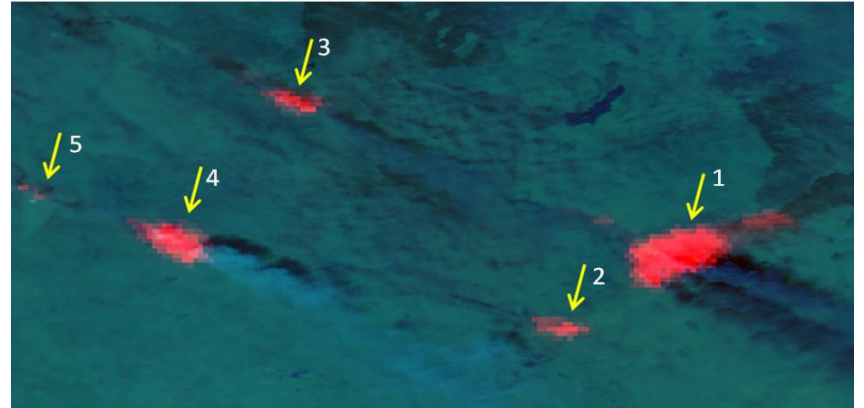
FY-3D/MERSI-II 10.8 um grassland fire image at 04:25 of April 20, 2019



FY-3D/MERSI-II 3.8 um grassland fire image at 04:25 of April 20, 2019



FY-3D/MERSI-II 10.8 μ m, 0.86 μ m and 0.65 μ m composite image at 04:25 of April 20, 2019



FY-3D/MERSI-II 3.8 μ m, 0.86 μ m and 0.65 μ m composite image at 04:25 of April 20, 2019

Wildfire risk prediction

For wildfire prevention to avoid property losses, wildfire risk prediction method is studied based on the long-time series fire information, as well as meteorological observation and forecast information.

$$U_M = I_t(t) + I_f(f) + I_v(v) + I_m(m)$$

t: daily maximum temperature

f: daily minimum relative humidity

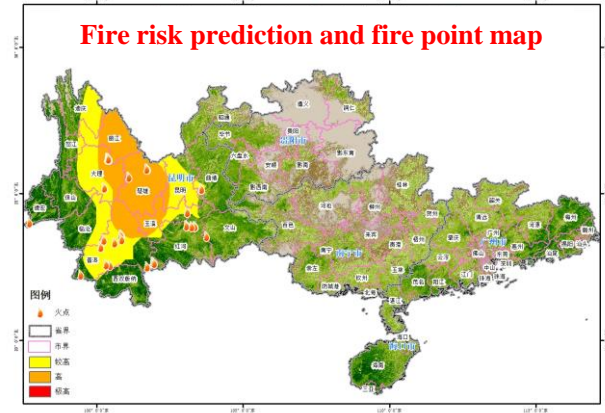
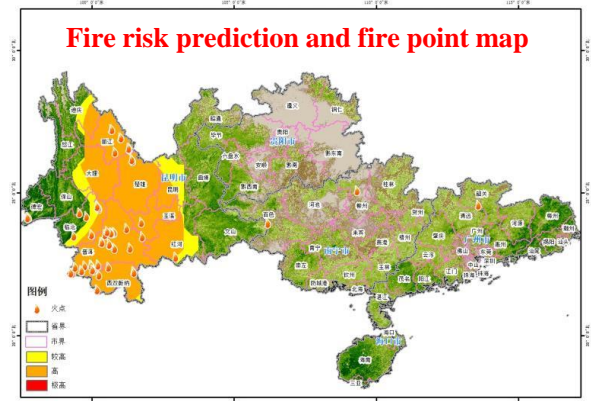
v: daily maximum wind speed

m: daily maximum rainfall and consecutive days without rain

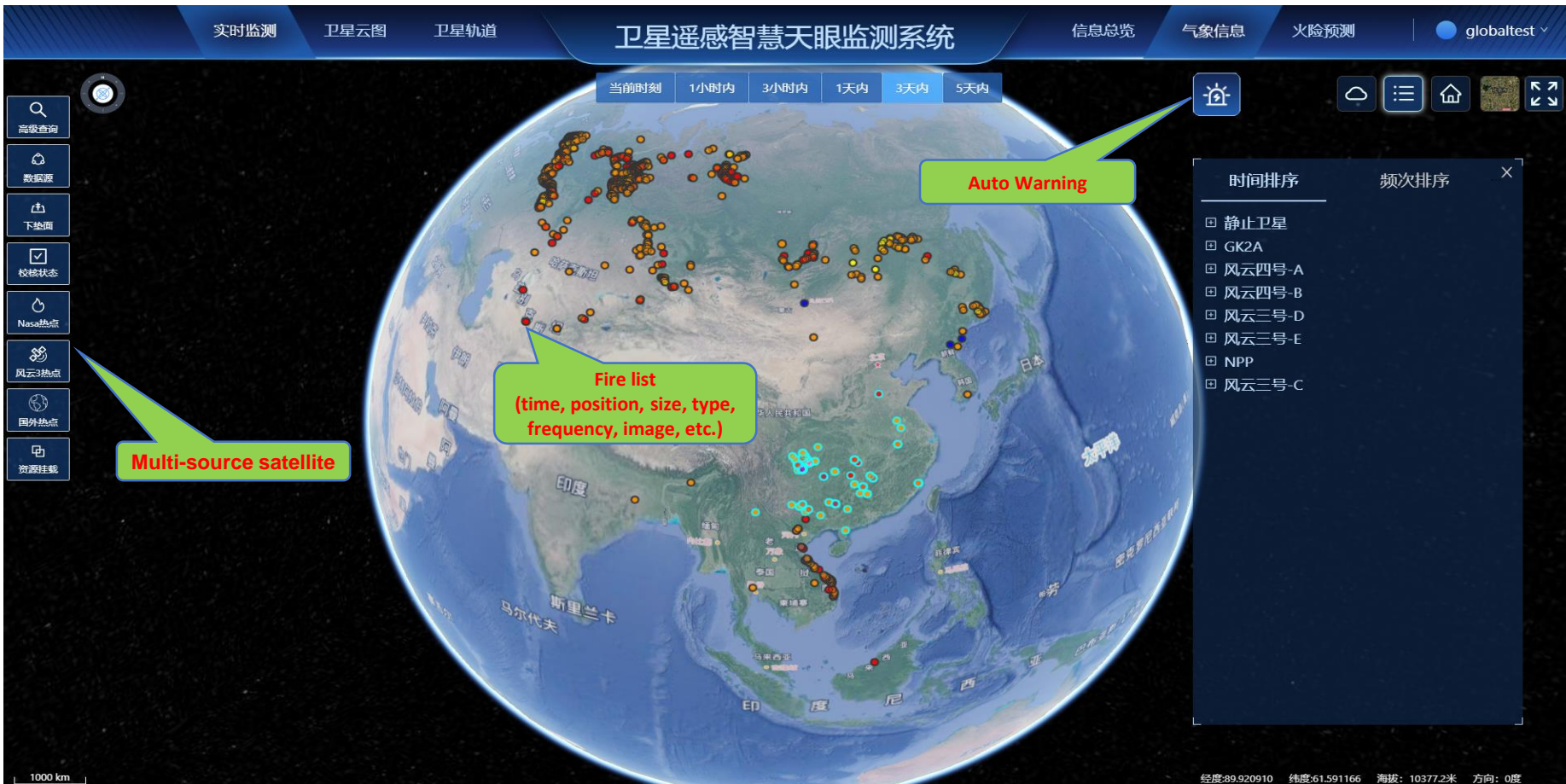
$$F = U_M + I_R(R)$$

R: fire point statistic from FY satellite data

The prediction method has been applied in South China with good results. The fire point is superimposed on the fire risk prediction area, with high consistency. The method can be extended to other regions.



Satellite real-time fire monitoring intelligent 3D platform





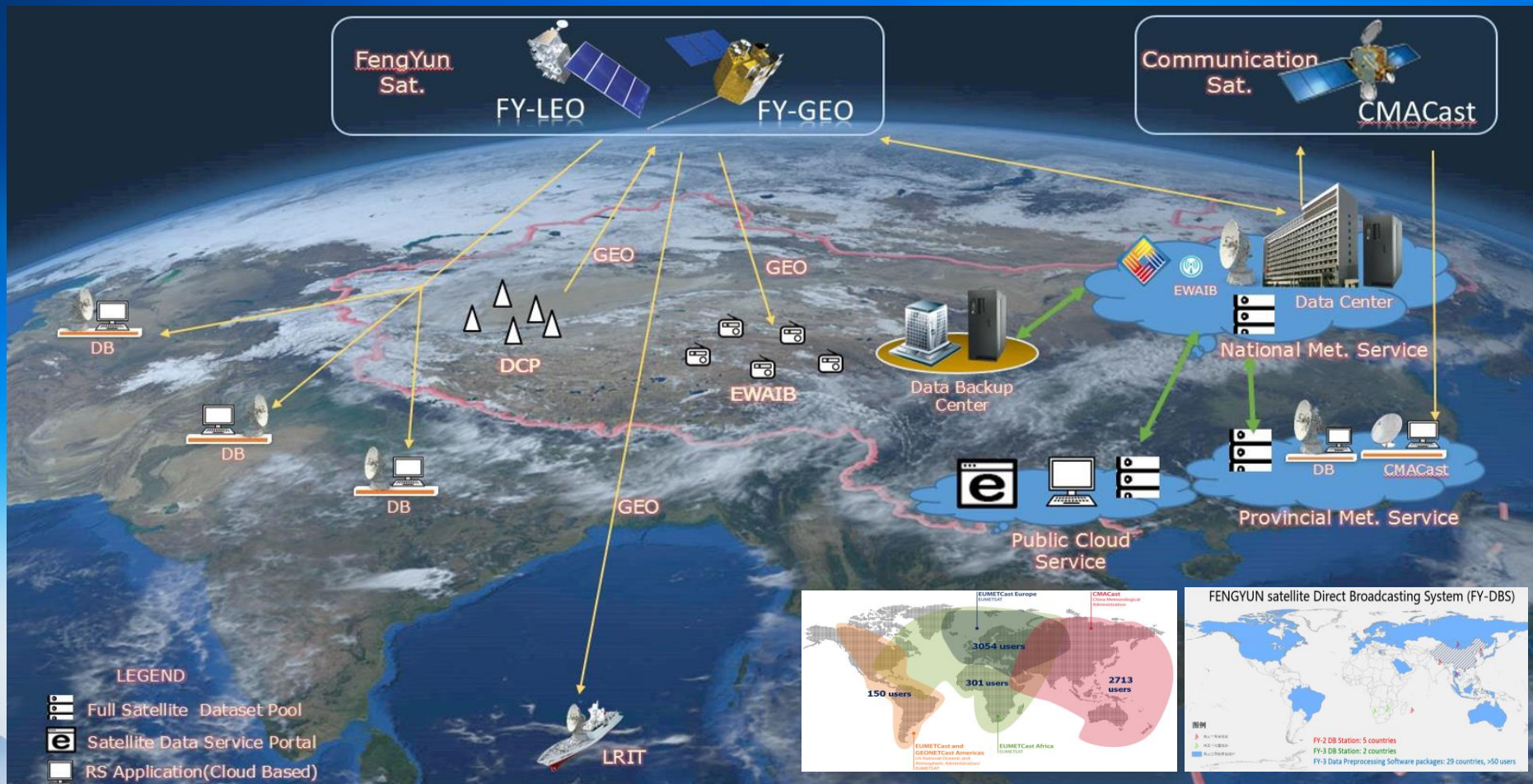
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1. FengYun Satellite Program Overview
2. Typical Applications and Examples
- 3. FengYun Satellite Data Access**
4. FengYun Satellite Applications Tools
5. International Cooperation
6. Actions and Plans

FengYun Satellite Data Service

Type	User	Time
Website	All user	Non real-time
Direct B roadcast	Agreement user	Real-time
CMAcast (FY-4A, FY-3D)	Agreement user	Real-time
FTP service	All user	Non real-time
Emergency data service	Agreement user	Real-time
GTS /WIS	Agreement user	Non real-time
China-EU data exchange	Agreement user	Non real-time
Manual Service	All user	Non real-time

Data services



Web services

The screenshot shows the FENGYUN Satellite Data Center website. At the top, it says 'Welcome to FENGYUN Satellite Data Center. Please Sign in Register NSMC Contact us Help 中文'. The main header is 'FENGYUN Satellite Data Center' with the logo of the NATIONAL SATELLITE METEOROLOGICAL CENTER. Below the header is a navigation bar with 'SATELLITES DATA IMAGES PRODUCTS DOCUMENTS TOOLS' and a search bar. The main content area features a banner for 'FY-3E Shares First Batch of L1 Data'. There are several sections: 'Archive' with a table of satellite data, 'FY-LEO TANSAT FY-GEO' filters, a 'Sign In' form, 'Statistics' showing 'DOWNLOAD SINCE 2005 (MB) 3,614,459,070 MB', a 'TRACK' map, 'Orbit Parameters', and a 'Data download' section with options for 'Data Format', 'Auxiliary Data', and 'Application Forms'. The footer contains the NSMC logo and contact information: 'China Meteorological Administration National Satellite Meteorological Center Copyright © NSMC 2013. All Rights Reserved. Email:dataserver@cma.gov.cn 京公网安备 110108002134号 京ICP备09070567号'.

data.nsmc.org.cn/portalsite/

- All 31 PB archived data (incl. real time)
- Satellites' information
- Satellite images browsing
- Documents and tools

User: freely register, update need authorization

- ❖ Normal: 30GB/day
- ❖ Senior: 100GB/day

Application form: <https://satellite.nsmc.org.cn/PortalSite/StaticContent/DocumentDownload.aspx?TypeID=8>

The screenshot shows the 'Data download' section of the website. It has a table with columns for 'Data Format', 'Auxiliary Data', and 'Application Forms'. The 'Application Forms' row is highlighted with a red box, and a red arrow points to the 'User upgrade application form' link. Below the table, there is a red box with the text 'Click to download the form'.

Click to download the form

Windows users

CMA released the FY Satellite Data Download Toolkit

Satellite **Product**

▼ LEO satellite

- FY-3D**
- FY-3C
- FY-3B
- FY-3A
- FY-1D
- FY-1C
- NOAA-18
- NOAA-17
- NOAA-16
- NOAA-15
- AQUA
- TERRA
- METOPB
- ▼ GEO satellite
- FY-4A

Instrument
GAS(GAS)

Type
L0 Data(L0)

Time range
 Beijing time 2019-07-18 00:00 [calendar] to 2019-07-19 23:59 [calendar] Each day
 UTC time

Spatial Selection Location: Whole Area Whole Area

China **Asia** **Africa** **Europe** **North America** **South America** **Oceania**

<input type="radio"/> Anhui	<input type="radio"/> Beijing	<input type="radio"/> China	<input type="radio"/> Chongqing
<input type="radio"/> Fujian	<input type="radio"/> Gansu	<input type="radio"/> Guangdong	<input type="radio"/> Guangxi
<input type="radio"/> Guizhou	<input type="radio"/> Hainan	<input type="radio"/> Hebei	<input type="radio"/> Heilongjiang
<input type="radio"/> Henan	<input type="radio"/> Hong Kong	<input type="radio"/> Hubei	<input type="radio"/> Hunan
<input type="radio"/> Inner Mongolia	<input type="radio"/> Jiangsu	<input type="radio"/> Jiangxi	<input type="radio"/> Jilin
<input type="radio"/> Liaoning	<input type="radio"/> Macao	<input type="radio"/> Ningxia	<input type="radio"/> Qinghai

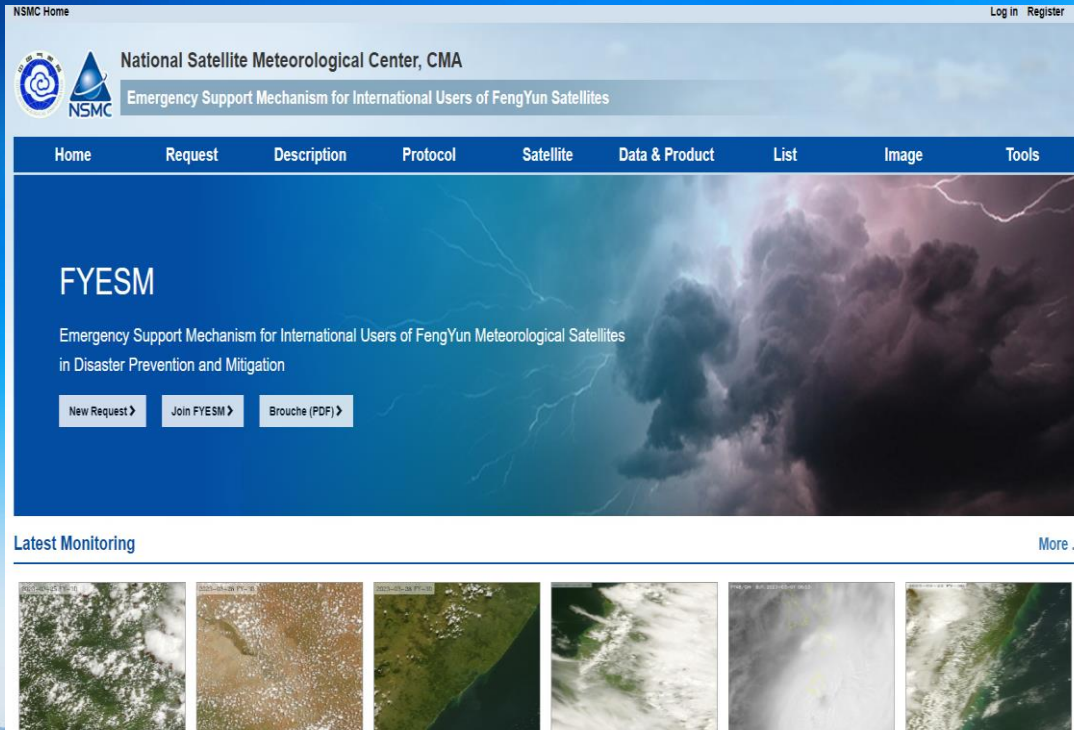
- ✓ Data Search
- ✓ Download Monitor
- ✓ Subscribe
- ✓ Breakpoint resume

**FY-3 Preprocessing
Software Packages**


Emergency Users:

Upgrade FY_ESM website and dataflow to support more efficient service.

<http://www.nsmc.org.cn/service/en/emergency/index.html>



NSMC Home Log in Register

 National Satellite Meteorological Center, CMA
Emergency Support Mechanism for International Users of FengYun Satellites


Home Request Description Protocol Satellite Data & Product List Image Tools

FYESM

Emergency Support Mechanism for International Users of FengYun Meteorological Satellites
in Disaster Prevention and Mitigation

[New Request >](#) [Join FYESM >](#) [Brouche \(PDF\) >](#)

Latest Monitoring More ...



CMA introduced the Emergency Support Mechanism of FENGYUN (FY) Satellite (FY ESM) to international users who made a request once visited by such extreme events as typhoon, heavy rain, severe convection, forest or grassland fire and sand and dust storm.

Emergency Support Mechanism for International Users of FengYun Satellites

<https://fy4.nsmc.org.cn/service/en/emergency/index.html>

National Satellite Meteorological Center, CMA NSMC Home
Emergency Support Mechanism for International Users of FengYun Satellites

Home Request Description Protocol Satellite Data & Product List Tools

FYESM

Emergency Support Mechanism for International Users of FengYun Meteorological Satellites in Disaster Prevention and Mitigation

Latest Monitoring

Types of disasters

New Request Join FYESM Brouche (PDF)

National Satellite Meteorological Center, CMA NSMC Home
Address: Zhongguancun East Road 44, Haidian, Beijing, China
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National Satellite Meteorological Center, CMA NSMC Home
Emergency Support Mechanism for International Users of FengYun Satellites

Home Request Description Protocol Satellite Data & Product List Tools

Country:

Organization:

Name:

Email:

Send to this Email

Event Type:

Location:

Longitude/Latitude:

Mouse Operation: Drag the map Range of choice

Satellite: FY3B FY3C FY3D FY4A (FY-4A) FY4E (FY-2E) FY4G (FY-2G) FY4I (FY-2I)

Start Time (UTC):

End Time (UTC):

Purpose:

Reference URL (if any):

Validate:

National Satellite Meteorological Center, CMA NSMC Home
Address: Zhongguancun East Road 44, Haidian, Beijing, China
Copyright © 2016. All Rights Reserved.



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2. Typical Applications and Examples
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4. **FengYun Satellite Applications Tools**
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FENGYUN EARTH

Comprehensive

Main User: Forecaster

Same underlying platform
Integrate resources
Complementary advantages

SWAP

(GEO)

Main User: Meteorologist

SMART

(LEO)

Main User: RS professional

Platforms: FengYun Earth

Comprehensive Cloud Platform

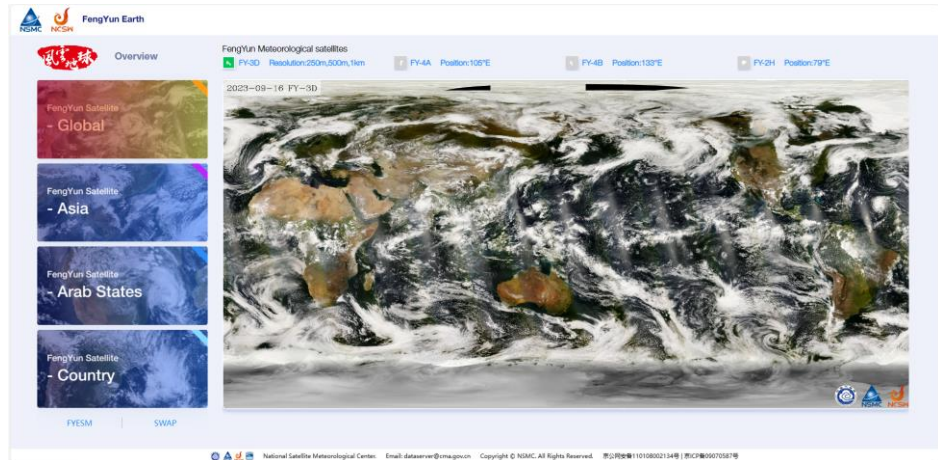
Main User: **Forecaster**

Typical Applications: **Weather Monitoring and Analyzing**

- Build an **integrated meteorological comprehensive product service platform**
- Realize **multi-source, multi-scale, multi-element, multi-form data access**
- Realize **automatic and intelligent processing and analysis of multidimensional data**
- Provide customizable comprehensive meteorological product services by different scale regions such as the **world, Asia, Africa, South America, countries, etc.**

Website

<http://fyearth.nsmc.org.cn/>



FengYun Earth -UI Design-Homepage

Entrance of global thematic product display

Entrance to thematic product display in Asia

Entrance to thematic product display in Africa

Entrance to thematic product display in South America



Overview



FYESM

SWAP

Geostationary satellite real-time cloud image option

FengYun Meteorological satellites

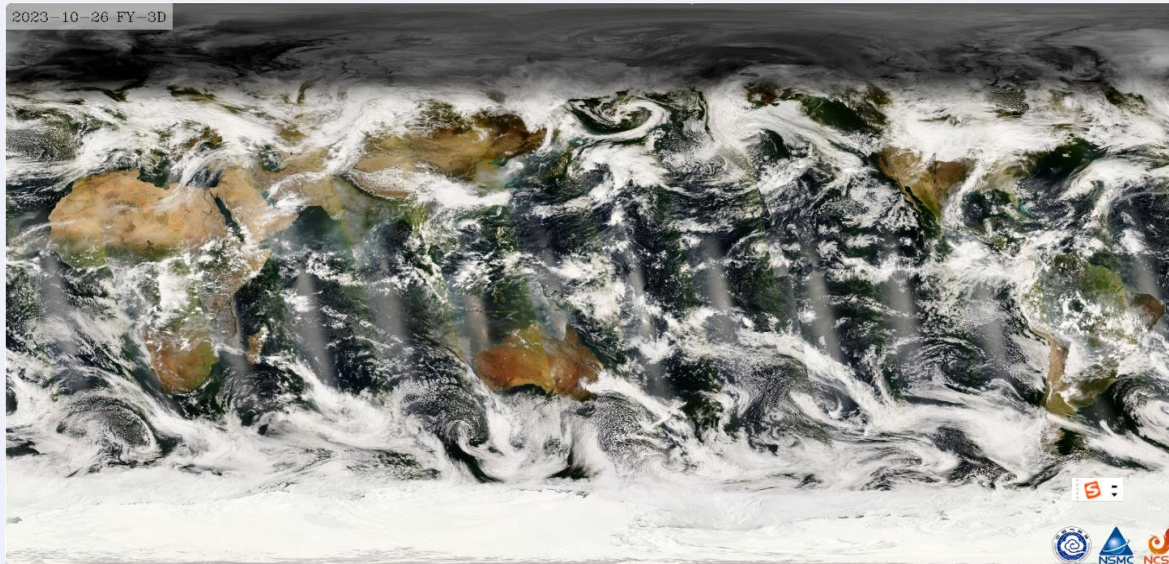
FY-3D Resolution:250m,500m,1km

FY-4A Position:105°E

FY-4B Position:133°E

FY-2H Position:79°E

2023-10-26 FY-3D



external system link

FengYun Earth



FengYun Earth | Asia

Image

Elements

Disaster Events

Climate

2023-09-18 02:38:24 (UTC)

2023-09-18 10:38:24 (LST)

Image

Cloud Image

0.65μm: Red Band

7.1μm: Water Vapor

10.8μm: Clean IR

GeoCLR

IR Enhance

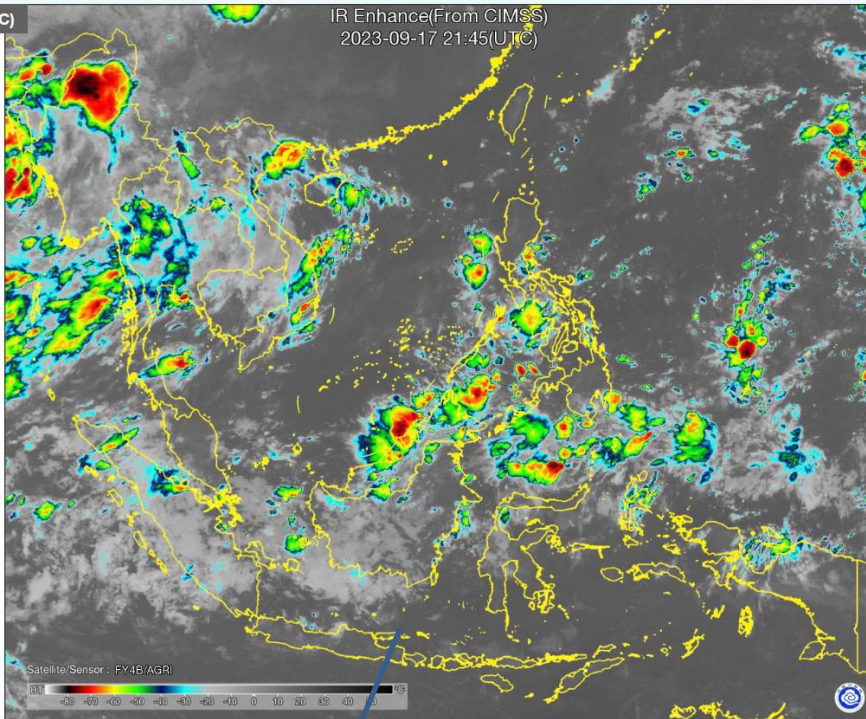
SWCI

Circulation

SouthEast...

IR Enhance 09-17 21:45 (UTC)

IR Enhance(From CIMSS)
2023-09-17 21:45(UTC)



More



National Satellite Meteorological Center. Email: dataserver@cma.gov.cn

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京公网安备110108002134号 | 京ICP备09070587号

Cloud Image Product List

Animation Play Command

Dynamic Thematic Maps

FengYun Earth -Product Page



FengYun Earth | Asia

Image

Elements and events

Disastrous weather

Climate

NWP Verification

2023-03-16 07:01:59 (UTC)
2023-03-16 15:01:59 (LST)

FengYun - asia / Snowstorm / Cold Wave in North America

Air Quality +

Cyclone +

Snowstorm -

Cold Wave in North America

Cold Wave in Europe

Atlantic Storm Eunice

Snowstorm in the USA

Snowstorm in the USA

Volcano +

Sandstorm +

Ice +

Flood +

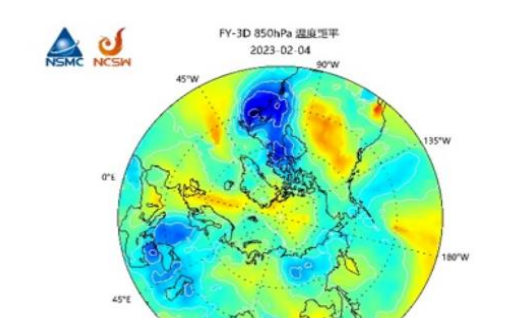
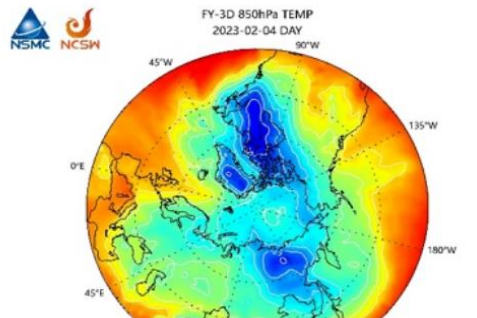
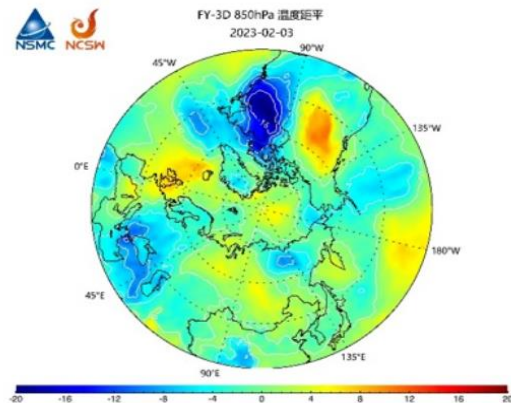
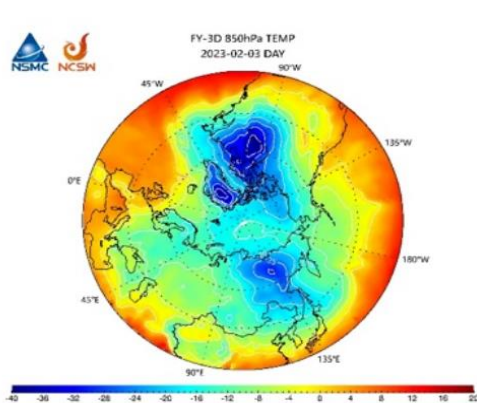
Firespot +

Emergency Support +

Ecological +

Drought +

Cold Wave in North America



FengYun Earth -Product



FengYun Earth | Global

Image

Elements

Disaster Events

Climate

3D

2023-10-2

2023-10-2

3D

Cloud Image

NDVI

LST

Month

Day

Wind

TimePicker

2023-09

2023-08

2023-07

2023-06

2023-05

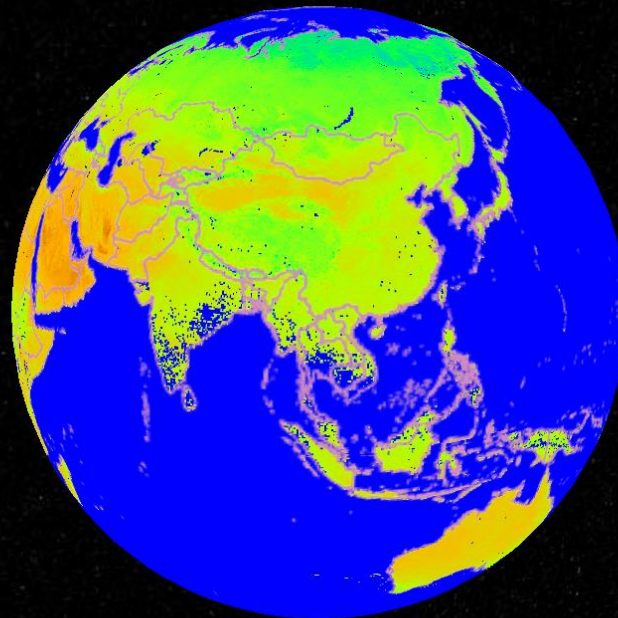
2023-04

2023-03

2023-02

2023-01

More



FengYun Earth -Product



FengYun Earth | Global

Image

Elements

Disaster Events

Climate

3D

2023-10-28 01:36:45 (UTC)
2023-10-28 09:36:45 (LST)

Elements

Wind

Ocean Wind

Vector Shaded

Wind Vector

Shaded Figure

Land Surface

Ocean

Radiation

TimePicker

2023-10-26

2023-10-25

2023-10-24

2023-10-23

2023-10-22

2023-10-21

2023-10-20

2023-10-19

2023-10-18

2023-10-17

2023-10-16

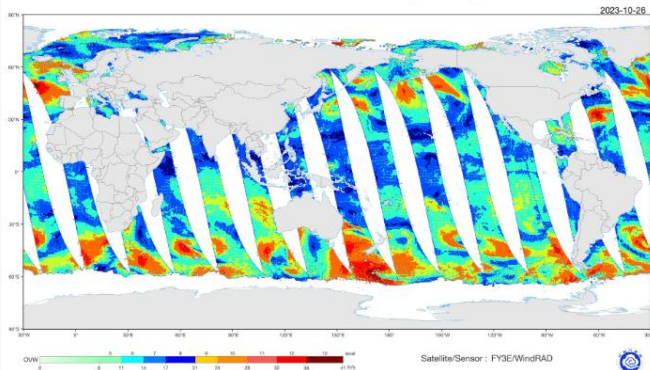
2023-10-15

2023-10-14

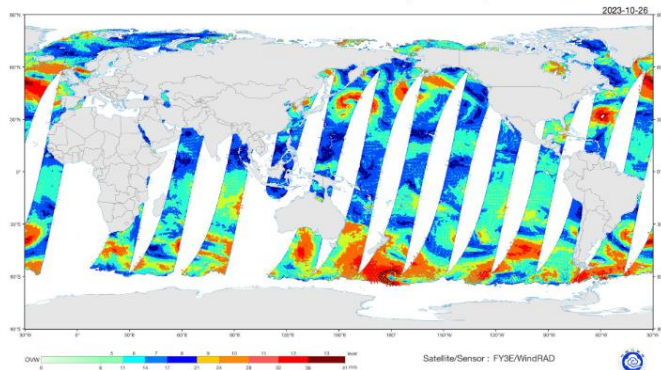
2023-10-13

More

Ocean Surface Wind Vector(Ascend)



Ocean Surface Wind Vector(Descend)



FengYun Earth -Product



Image

Element and event

Disastrous weather

NWP Verification

Disastrous weather

Temperature

Convective monitor

Convective initiation monitor

select time

06-05 00:15

06-02 00:15

05-31 00:15

05-30 00:15

05-29 06:15

05-29 06:00

05-29 03:15

05-29 03:00

05-29 00:15

05-17 09:00

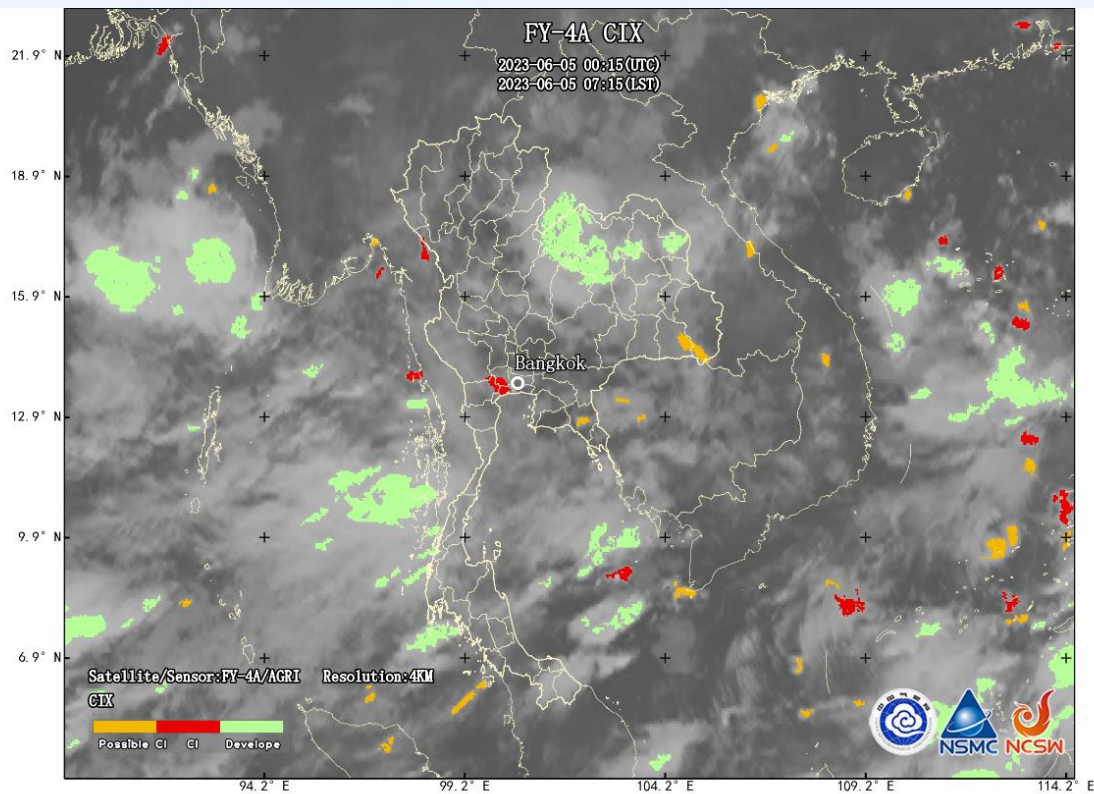
05-17 03:00

05-12 06:15

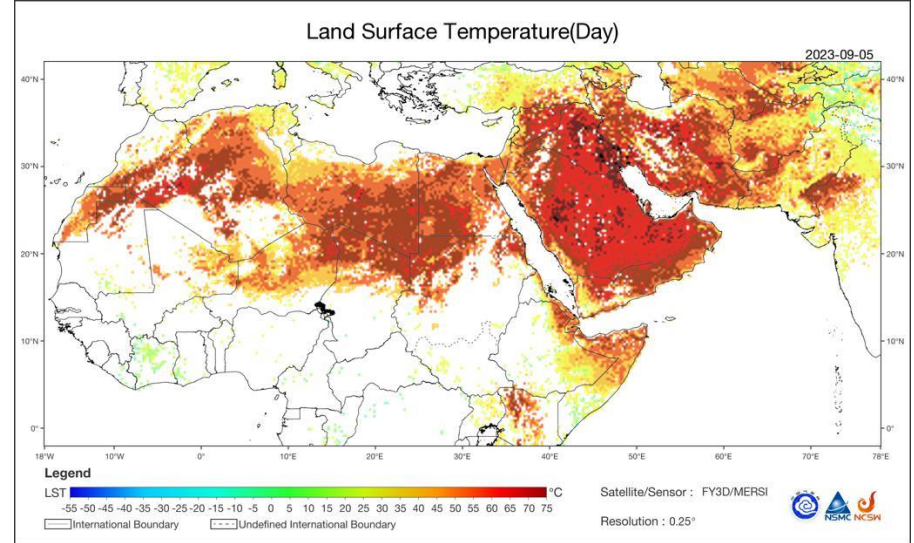
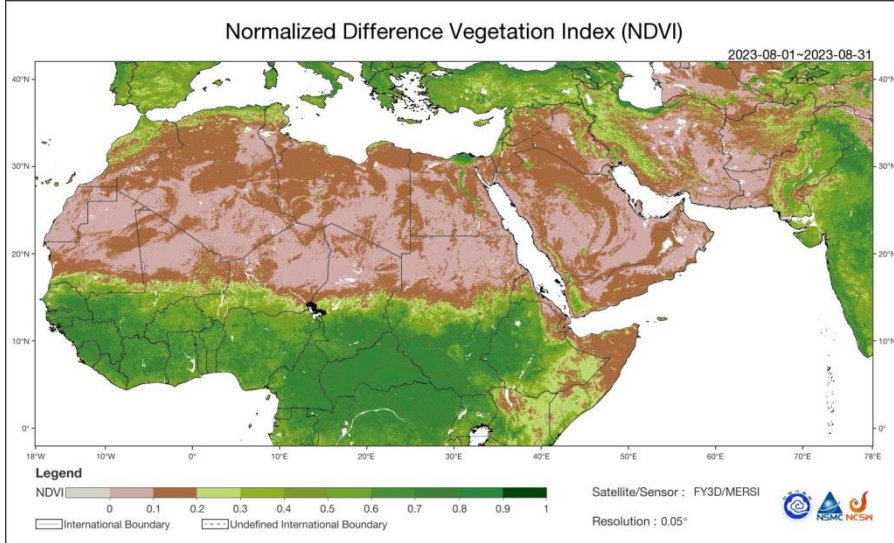
05-12 06:00

05-12 05:45

history»



FengYun Earth -Product



NDVI and Land Surface Temperature in Arab region

1. FENGYUN EARTH

2. SWAP

3. SMART

Platforms: SWAP

Weather monitoring and analysis---Geostationary Satellite data (FY-2/FY-4)

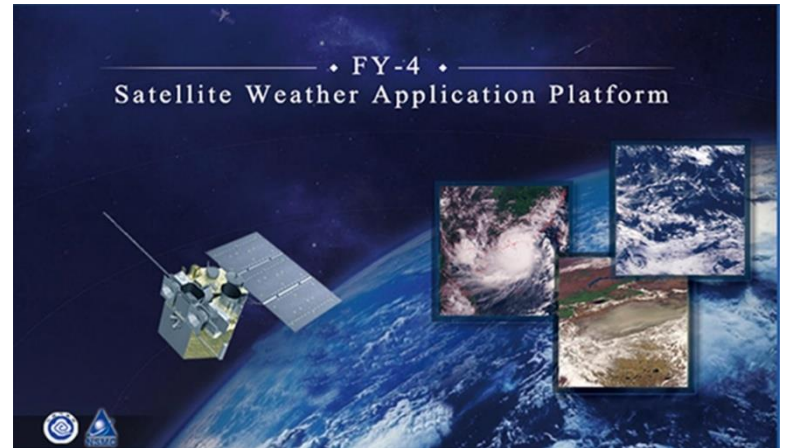
Platform for Geostationary Satellites

Main User: **Meteorologist**

Typical Applications: **Tropical cyclone, Convection, Sandstorm, Fire, etc.**



● SWAP Web version



● SWAP Stand-alone version

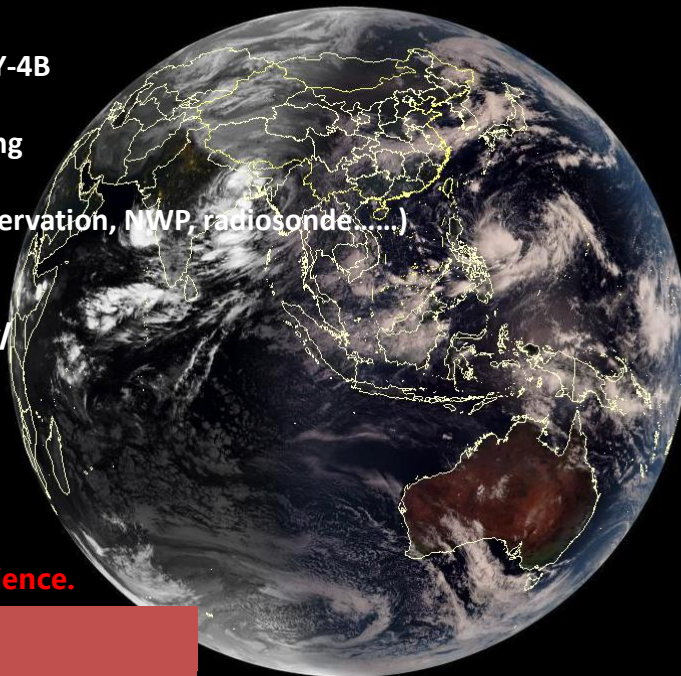
Platforms: SWAP (web version)

weather

Main functions

- Near real-time images of FY-2H , FY-4A, FY-4B
- 30+ GEO satellite products
- Special applications on weather forecasting
- Animation generation and sharing
- Multiple data analysis (radar, ground observation, NWP, radiosonde.....)
- Data statistics

http://rsapp.nsmc.org.cn/test_geofy/



Satellite Observation

Satellite FY-4A Projection Nomin

Observation Area Asia Region Full disk

Band Scheme Products

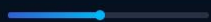
- True Color
- NatureColor_NoLit
- Natural Color RGB Composite (From WV)
- Dust RGB Composite (From WMO)
- AirMass RGB Composite (From WV)
- Fog/Snow RGB Composite (From WV)
- Severe Storms RGB Composite (From WV)
- CloudsConvection RGB Composite
- Volcanic Ash RGB Composite (From WV)
- Day Convective Storms RGB Composite
- Day Microphysics RGB Composite (From WV)
- Night Microphysics RGB Composite

Chrome is recommended for best user experience.

Supported browser:

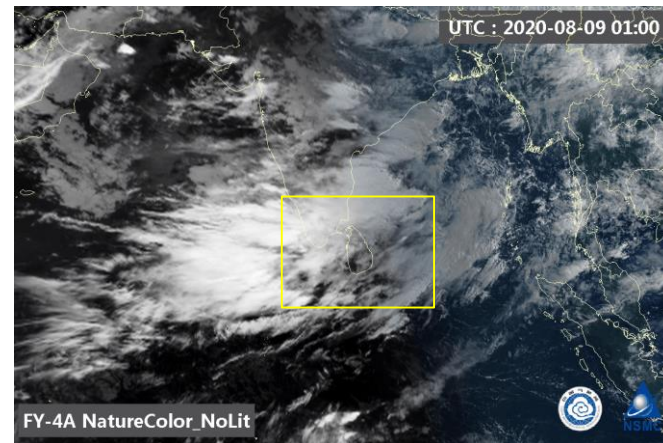
IE 10+	Edge 18+	Chrome 26+	Safari 8+	Opera 18+
YES	YES	YES	YES	YES

FY-4A True Color



SWAP-System Overview and features

SWAP has the ability of rendering single/multiple channel composites, and overlaying L2 products. SWAP is implemented with BS (Browser Service) architecture and accessed through web browser, users do not need to install extra software to access SWAP system.



Cloud based data access

- ❑ FY-4 satellite data access through data cloud, and performs automatic image tiling, publication, and update;
- ❑ SWAP has the ability of real-time rendering single/multiple channel composites, and overlaying

Comprehensive satellite data visualization

- ❑ Animation play and control;
- ❑ Keyboard shortcut for each function;
- ❑ Rolling screen for product animation comparison;
- ❑ Transparency control for image layer;
- ❑ Show/hide control for image layer;
- ❑ Online customizable markers;
- ❑ Right mouse key one-click resolution toggle

Online sharing of viewing window

- ❑ SWAP records current web page parameters, which enables online viewing window sharing
- ❑ After sharing web page link, user can resume current interactive status at any place

Cloud atlas animation export

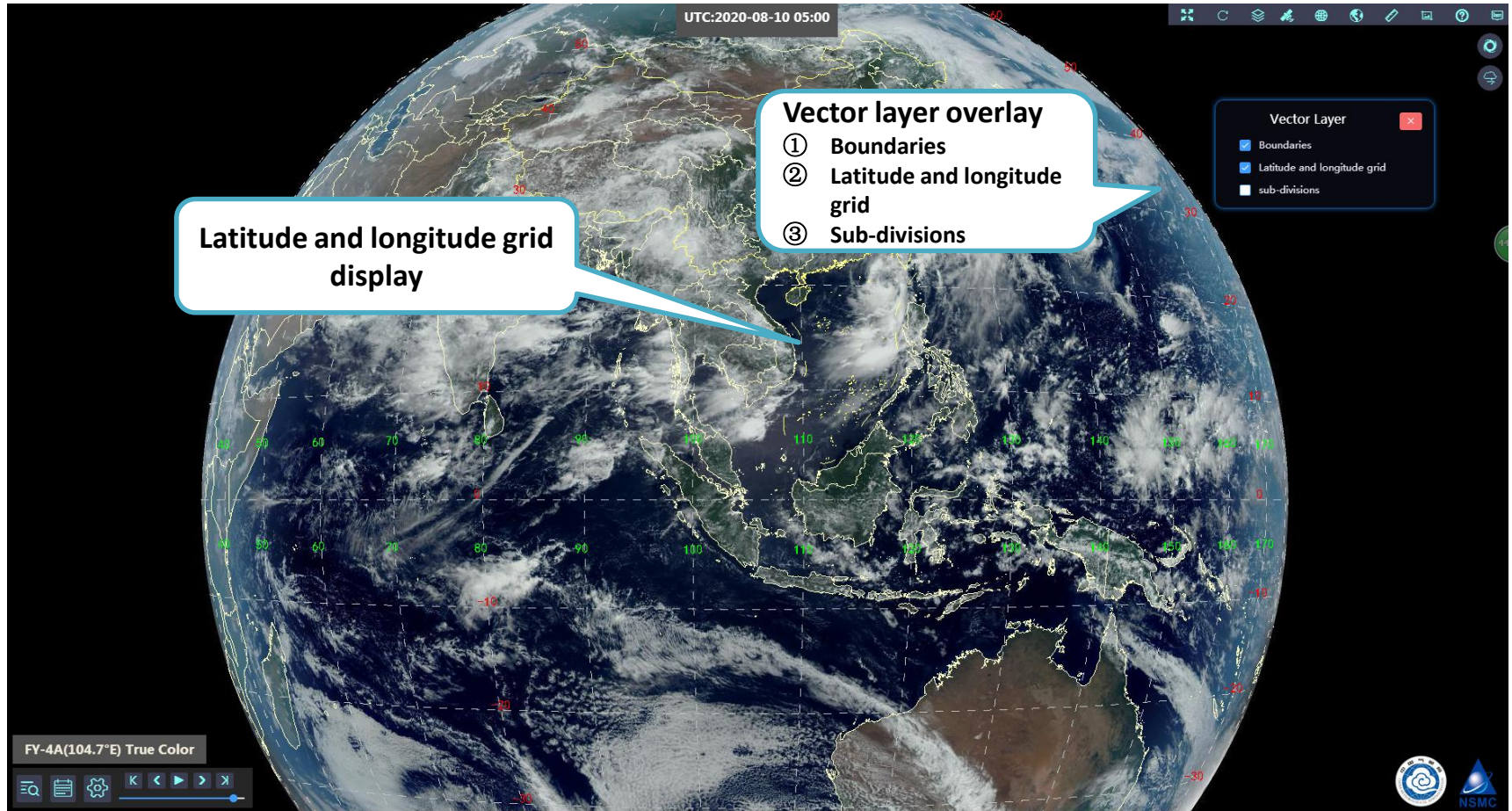
- ❑ User can export current viewing animation area as gif file.;
- ❑ Progress bar will show the animation export progress. .

SWAP Web version

The screenshot displays the SWAP Web version interface. The main content is a satellite view of Earth, showing the Asian continent and surrounding regions. The interface includes several control panels and callouts:

- Top Center:** A timestamp indicating the current frame: UTC:2023-10-22 08:45.
- Top Right:** A toolbar with icons for navigation and settings.
- Left Side (Callout):** A list of controls:
 - ① Time slider
 - ② Play control
 - ③ Speed control
 - ④ Playlist
 - ⑤ Archived data search
 - ⑥ Play Setting
- Right Side (Callout):** A list of features:
 - ① Full screen
 - ② Refresh
 - ③ Layer selection
 - ④ Satellite selection
 - ⑤ coordinate system
 - ⑥ Observation area
 - ⑦ Measure tools
 - ⑧ export animation to gif file
 - ⑨ Operation manual
- Bottom Left:** A panel labeled "FY-4A(104.7°E) True Color" with a toolbar for navigation and playback.
- Bottom Right:** Logos for NSIC, NCSW, and other organizations, along with a license number: 京公网安备110108002134号 | 京ICP备09070587号.

SWAP : Vector Layer overlay

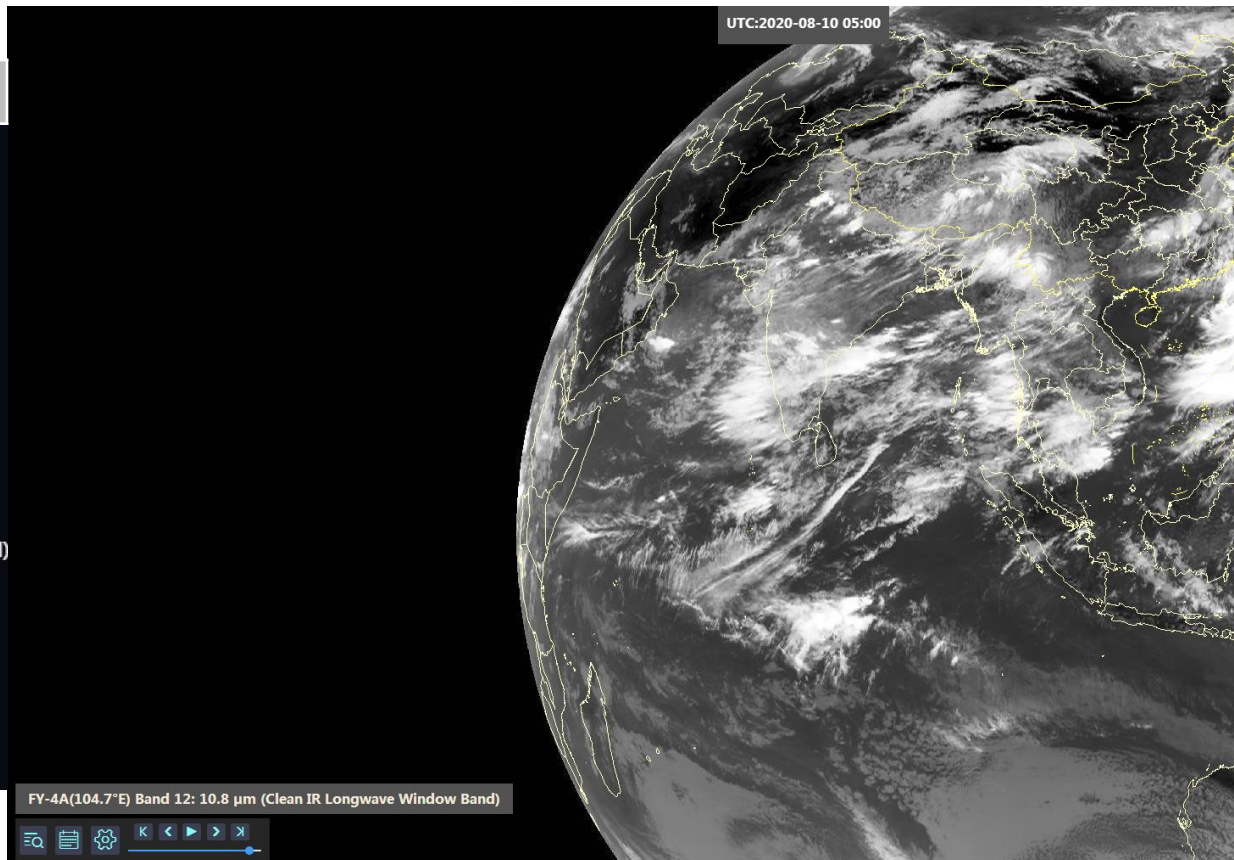


SWAP : Satellite channel view

SWAP FY4 Channel View

Satellite Band

- IR Enhance (From CIMSS)
- Band 1: 0.47 μm (blue Band)
- Band 2: 0.65 μm (Red Band)
- Band 3: 0.83 μm (Veggie Band)
- Band 4: 1.37 μm (Cirrus Band)
- Band 5: 1.61 μm (Snow/Ice Band)
- Band 6: 2.22 μm (Cloud Particle Size Band)
- Band 7: 3.72 μm (Shortwave Window Band High)
- Band 8: 3.72 μm (Shortwave Window Band Low)
- Band 9: 6.25 μm (Upper-Level Tropospheric Water Vapor Band)
- Band 10: 7.1 μm (Lower-level Water Vapor Band)
- Band 11: 8.5 μm (Cloud-Top Phase Band)
- Band 12: 10.8 μm (Clean IR Longwave Window Band)
- Band 13: 12 μm (Dirty Longwave Window Band)
- Band 14: 13.5 μm (CO2 Longwave Infrared Band)

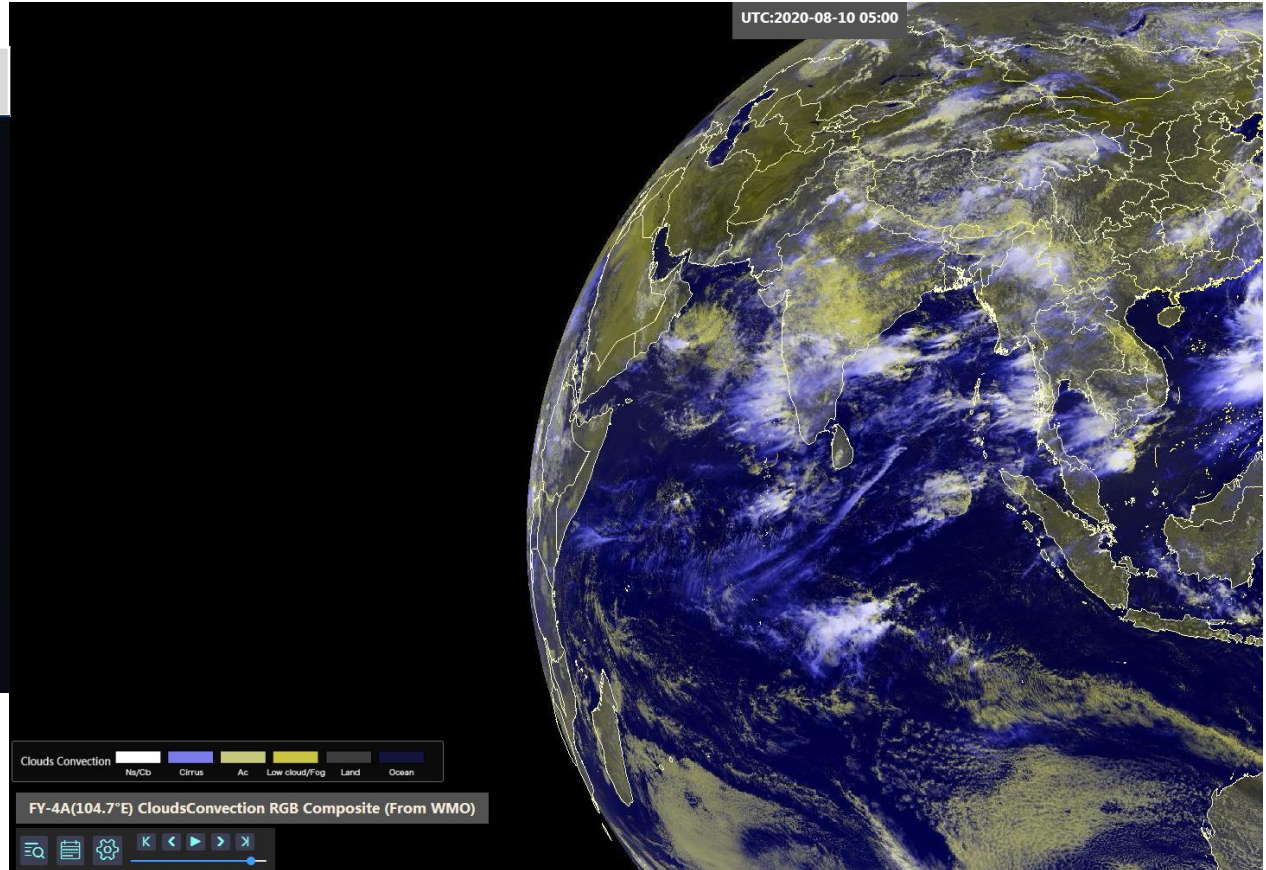


SWAP : Synthetics scheme

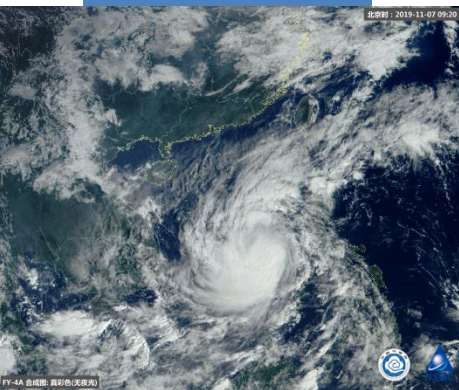
SWAP Support 12 Synthetics scheme

Synthetic scheme

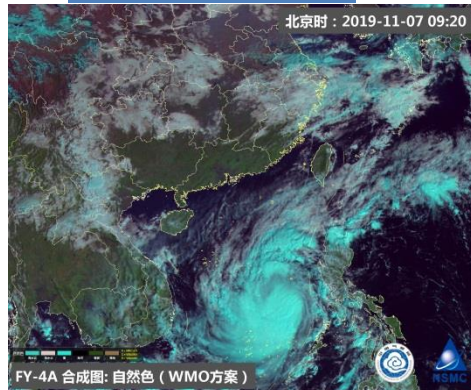
- NatureColor
- NatureColor_NoLit
- Natural Color RGB Composite (From WMO)
- Dust RGB Composite (From WMO)
- AirMass RGB Composite (From WMO)
- Fog/Snow RGB Composite (From WMO)
- Severe Storms RGB Composite (From WMO)
- CloudsConvection RGB Composite (From WMO)
- Volcanic Ash RGB Composite (From WMO)
- Day Convective Storms RGB Composite (From WMO)
- Day Microphysics RGB Composite (From WMO)
- Night Microphysics RGB Composite (From WMO)



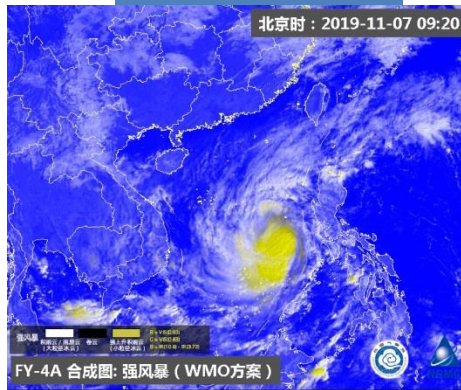
true colors



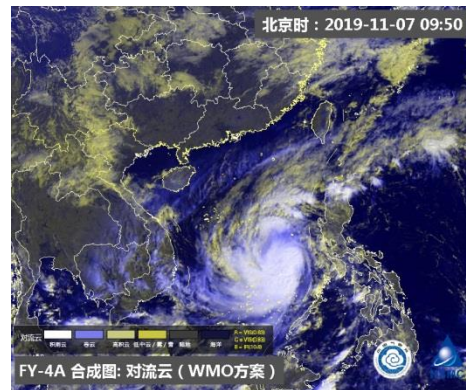
natural colors



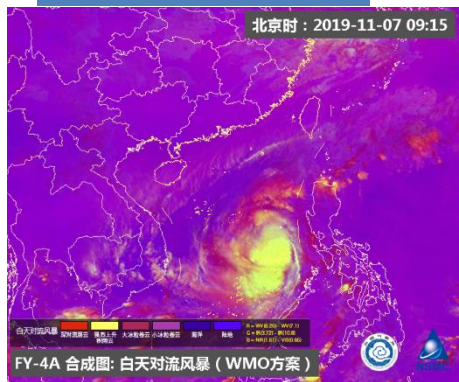
Severe storms



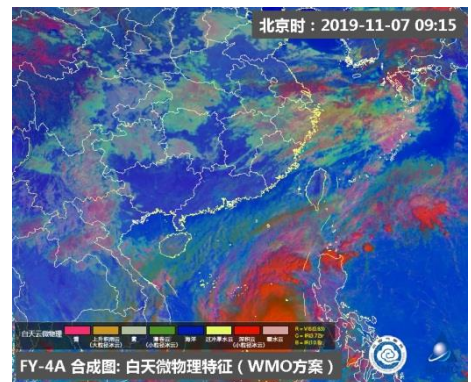
clouds convection



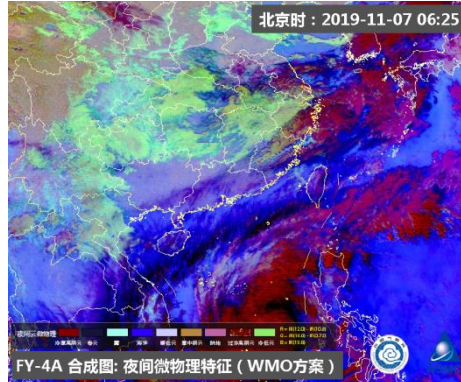
day convective storms



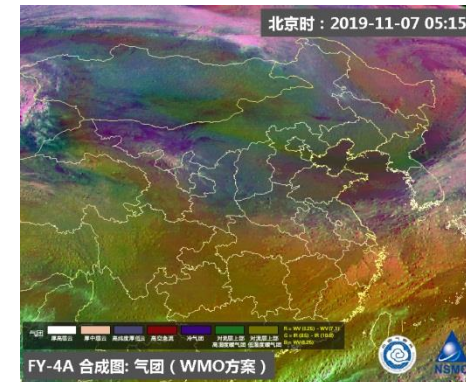
day microphysics



Night microphysics

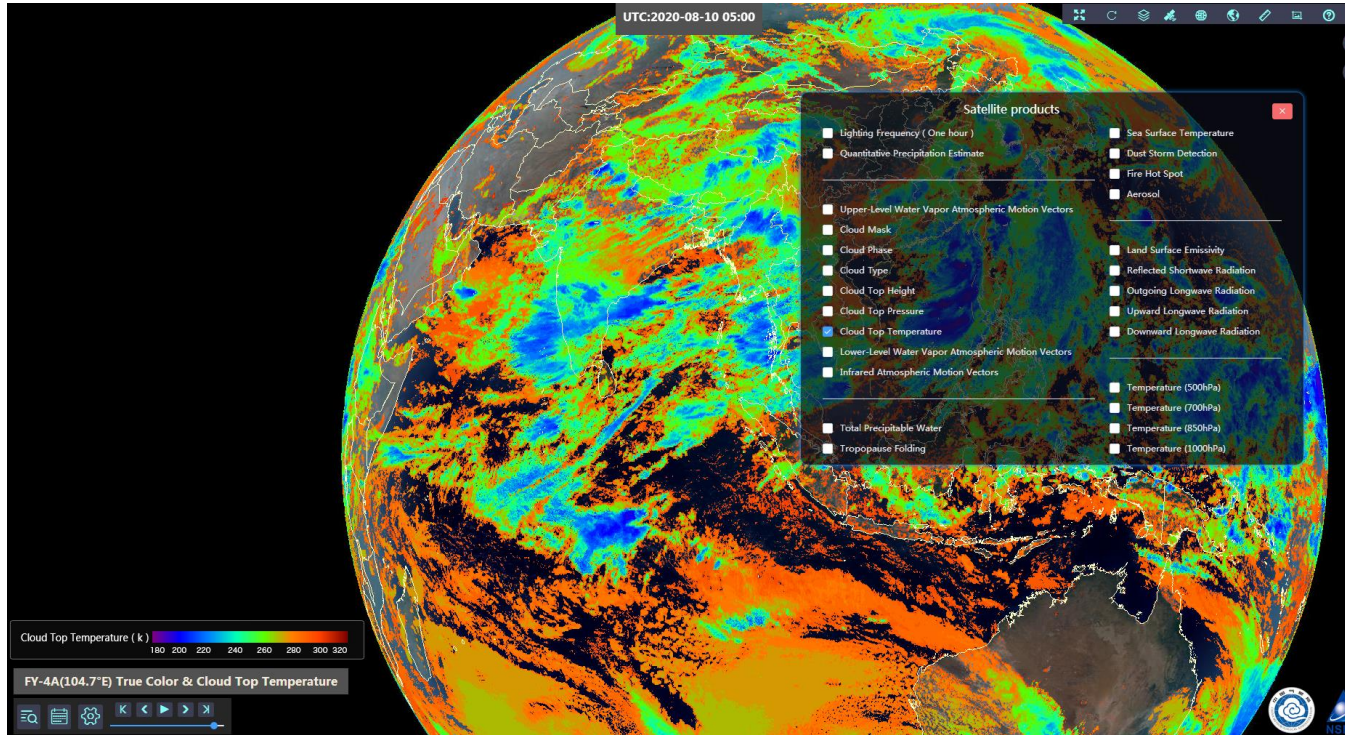


air mass



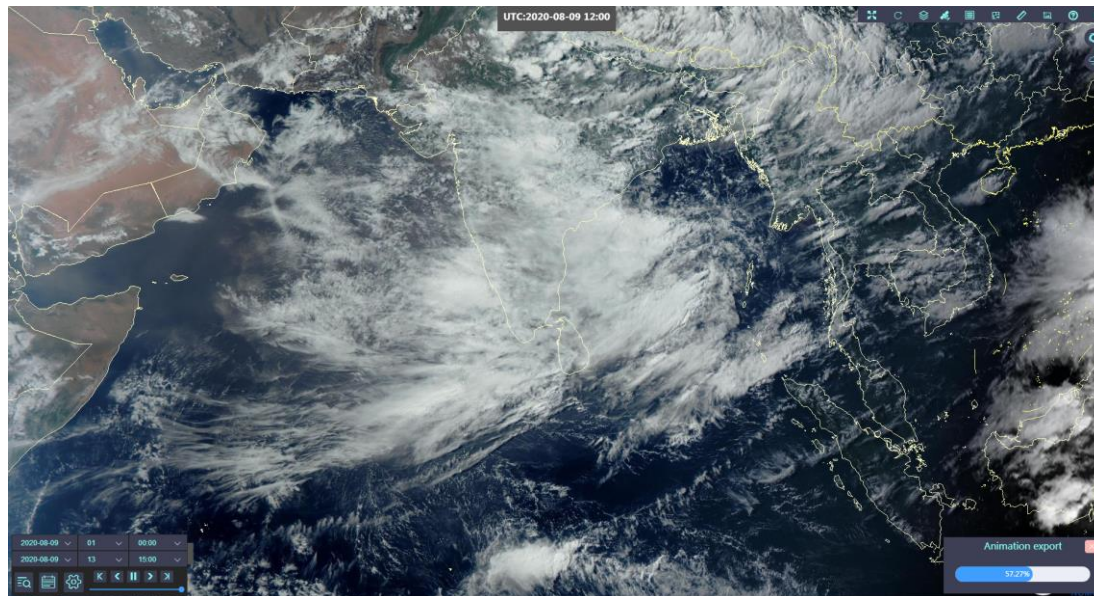
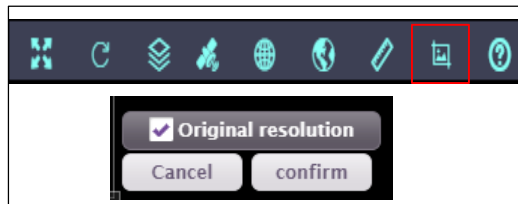
SWAP : Satellite product overlay

SWAP Support 30+ Products



- Cloud Mask
- Cloud Type
- Dust Storm Detection
- Outgoing Longwave Radiation
- Quantitative Precipitation Estimate
- Surface Solar Irradiance
- Atmospheric Vertical Profile
- Number of Lightning Events (Count/min)
- Cloud Phase
- Cloud Top Height
- Cloud Top Temperature
- Cloud Top Pressure
- Downward Longwave Radiation (DLR)
- Upward Longwave Radiation (ULR)
- Reflected Shortwave Radiation (RSR)
- Tropopause Folding
- Land Surface Emissivity
- Sea Surface Temperature
- Fire Hot Spot
- Layer Precipitable Water (Contain Total Precipitable Water)
- Upper-Level Water Vapor Atmospheric Motion Vectors
- Convective Initiation

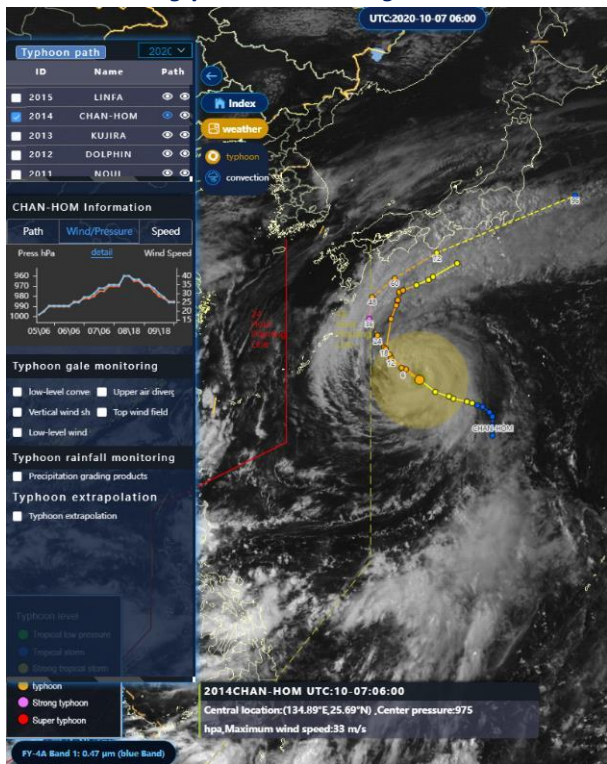
SWAP : Animation export



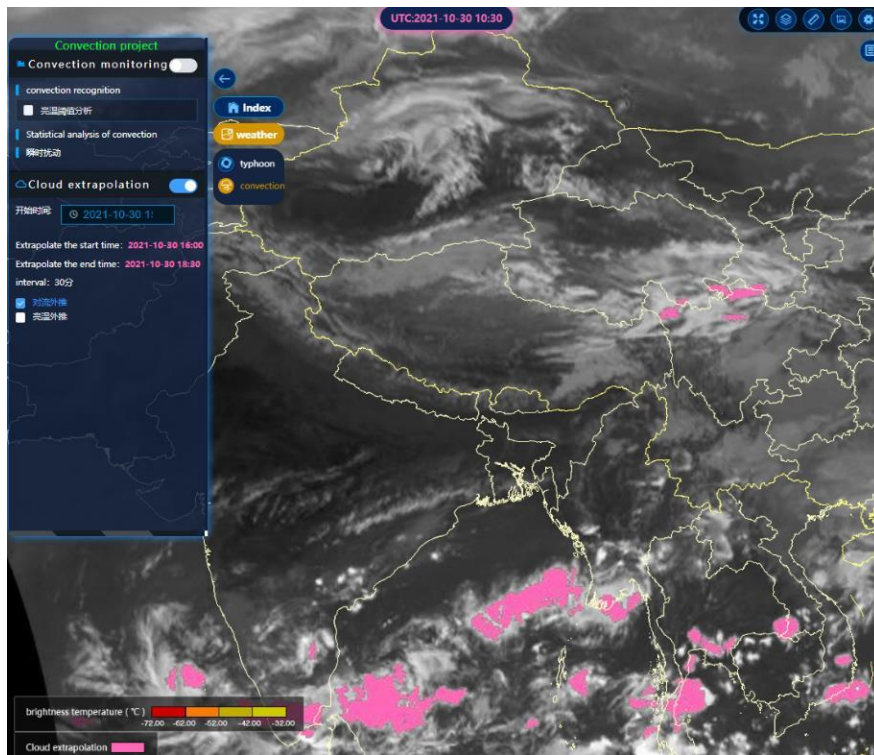
http://rsapp.nsmc.org.cn/FY4A/exp_gif/20200810/1597048891753_11_1.gif

SWAP : analysis

Typhoon analysis



Convective analysis and forecast



SWAP : Archiving images

Play list

2019-07-31 10:00
2019-07-31 10:45
2019-07-31 11:00
2019-07-31 11:15
2019-07-31 13:00
2019-07-31 13:45
2019-07-31 14:00
2019-07-31 14:15

Archived data query

2019-07-31 08 15:00
2019-07-31 14 15:00

Setting Control

2019-07-31 00 00:00
2019-08-23 06 15:00



SWAP(stand-alone version) -features

SWAP stand-alone version can support provincial CMACast default folder structure, and support Provincial direct receiving station data format. and support Custom data access. And support System file selector and manual file selection. Realizing comprehensive display of FY-4A and FY-2 series satellite data, **interactive** typhoon positioning / intensity estimation, and strong convective system analysis. **Displaying L1 data, compositing multiple channel data, playing animation, rendering L2 data, etc.**

Data Access

- ◆ Provincial CMACast default folder structure support
- ◆ Provincial direct receiving station HRIT format support
- ◆ Custom data access with configuration file
- ◆ System file selector and manual file selection support

Comprehensive FY4 and FY2 satellite data display

- ◆ Nominal geostationary satellite coordinate system support
- ◆ Single-frame cloud atlas and multi-frame animation support
- ◆ Flexible channel toggle and layer management
- ◆ Single channel pseudo-color enhancement with specific color map
- ◆ L2 data overlay display
- ◆ Cloud atlas animation file export
- ◆ FY-4A true color composite

Thematic application

Strong convective system interactive analysis

- ◆ Default and manual ROI selection
- ◆ Interactive parameter configuration, real time analysis result display

Cyclone positioning and intensity estimation

- ◆ Pixel level positioning and inverse positioning based on cloud atlas
- ◆ Interactive point selection and spiral fitting
- ◆ Spiral parameter adjustment

SWAP Interface layout

FY-4 Satellite Weather Application Platform 1.0

File Satellite Image Product Data Weather Application Tool View Settings

Menu Bar toolbar Animation control bar

UTC:2018/09/27 06:15:00
Channel 12:Long Wave Infrared(10.8 μ m)

Interactive panel switching

Animations Channel Layers

Animations

Data Settings

Satellite type: FY4A

Data Type: FY4A China Region

Data Path R:\FY4A\AGRI\L1\FDI\REGC

Animation Content:

Last Session (Hours): 6

Arbitrary Session (UTC)

2018/9/27 days 8 Hour 14

to

2018/9/27 days 14 Hour 14

Custom session 51/51

2018/09/27 00:15:00
2018/09/27 00:30:00
2018/09/27 00:34:17
2018/09/27 00:38:34
2018/09/27 00:45:00
2018/09/27 00:49:17
2018/09/27 00:53:34
2018/09/27 01:00:00
2018/09/27 01:15:00
2018/09/27 01:19:17
2018/09/27 01:23:34
2018/09/27 01:30:00
2018/09/27 01:34:17
2018/09/27 01:38:34
2018/09/27 01:45:00
2018/09/27 01:49:17
2018/09/27 01:53:34
2018/09/27 02:00:00
2018/09/27 02:15:00

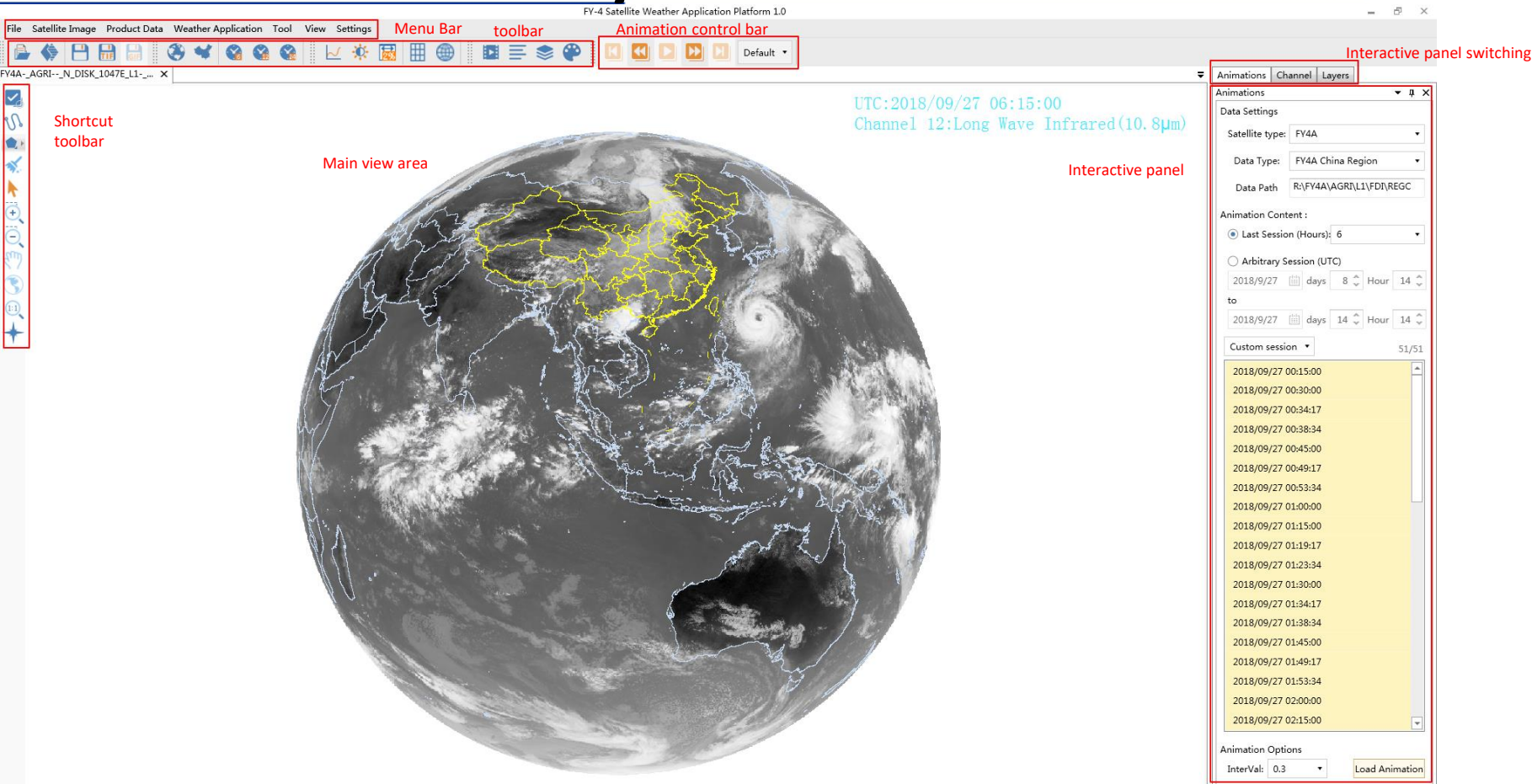
Animation Options

InterVal: 0.3 Load Animation

Shortcut toolbar

Main view area

Interactive panel



1. FENGYUN EARTH

2. SWAP

3. SMART

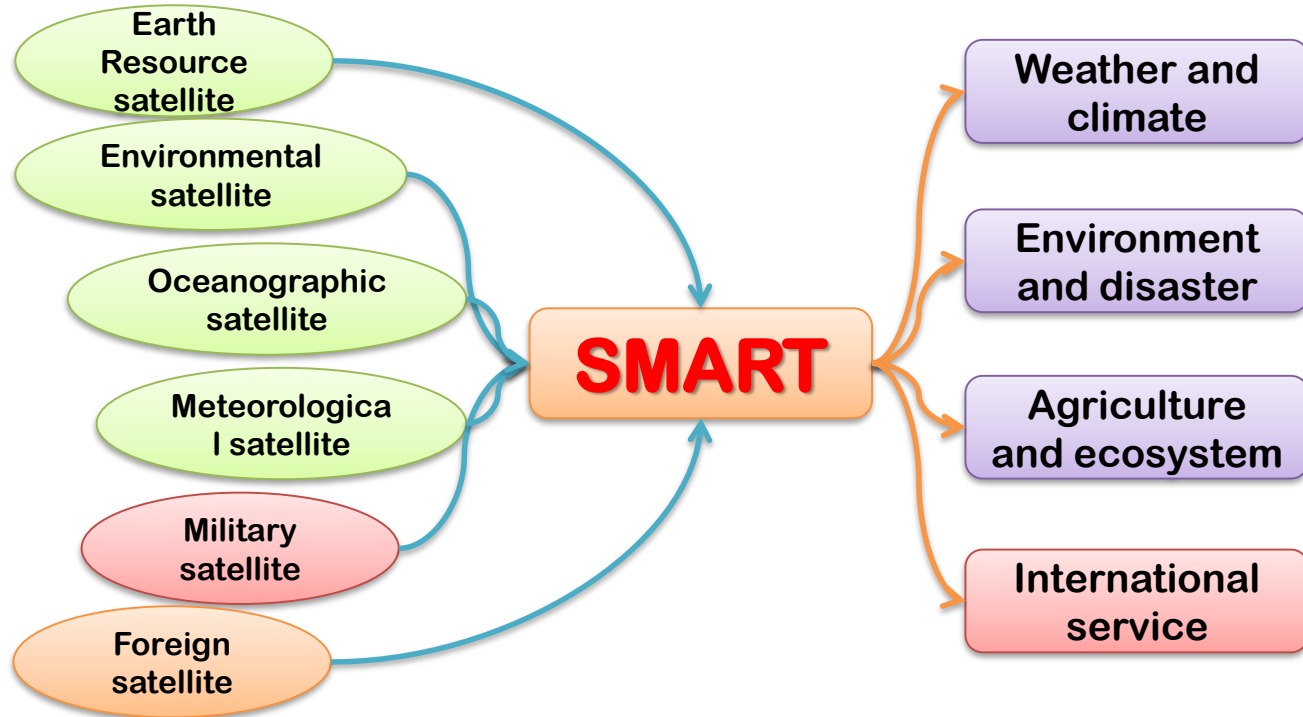
SMART

SMART(Satellite Monitoring Analysis & Remote sensing Toolkit) is a general application platform developed by NSMC that offers FY-3-based monitoring outputs, data analyses and public services. It is a comprehensive application platform for remote sensing monitoring and application using FY-3 and other meteorological satellite Data.



Natural disaster and environment monitoring and analysis
---polar orbit Satellite data

SMART

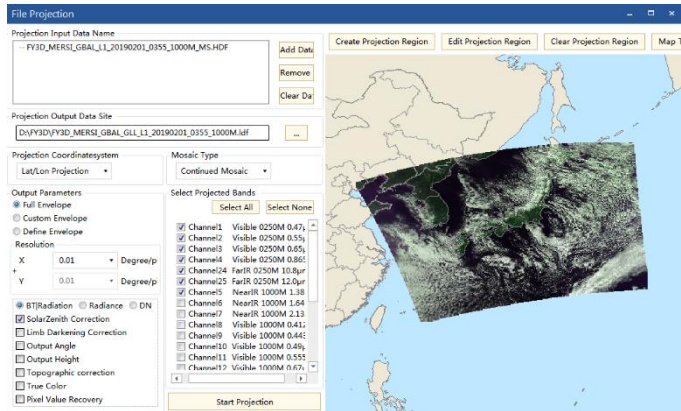


Multi-satellites Supporting

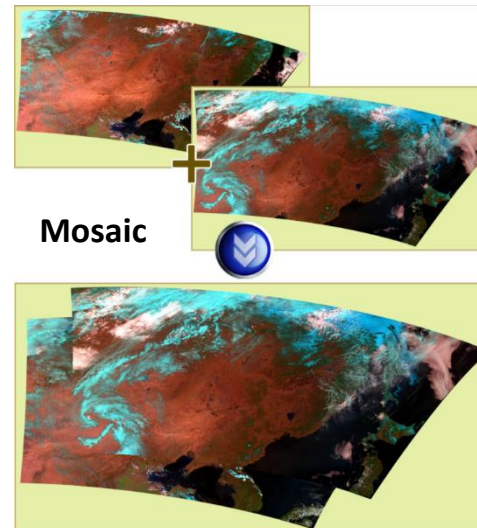
SMART-Main Functions

Tools of RS Data Processing

Monitoring & analysis system realizes many remote sensing processing functions, such as radiometric correction, projection, projection and coordinate system conversion, mosaic, resize, geometrical correction, True & Pseudo color composite, vector to raster, raster to vector, density slicing, texture feature extraction etc.



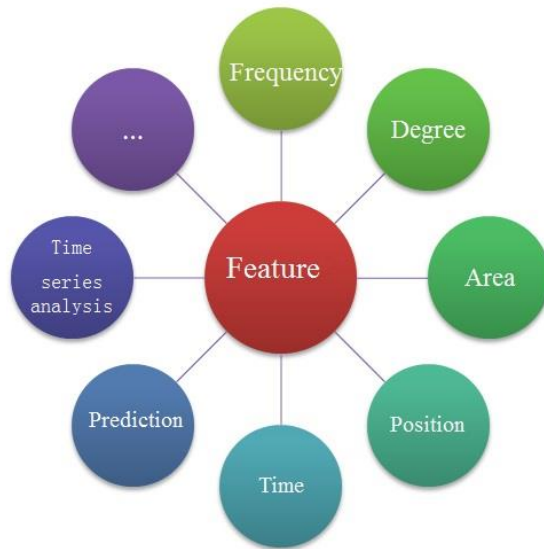
Projection



SMART-Main Functions

Monitoring & Analyzing Thematic Products

Monitoring & Analyzing Thematic Products



- Dust
- Fog
- Fire
- Water
- Snow
- Sea ice
- Cyanophyta
- Vegetation
- Drought
- Land surface temperature
- Urban Heat Island
- Extension of new production

Monitoring analysis content:

- Frequency
- Administrative region
- Area
- Location
- Time
- Changes
-

Data Application Tools

Users can login to www.nsmc.org.cn/en/ to download the FY Satellite Weather Application Platform (SWAP) and the FY Satellite Environmental and Ecological Monitoring System (SMART) to process and display FY satellite data.

SWAP & SMART

<http://www.nsmc.org.cn/service/en/emergency/tools.html>



The screenshot displays the 'FENGYUN Satellite Data Center' website. The header includes the site name and the National Satellite Meteorological Center (NSMC) logo. A navigation menu contains 'SATELLITES', 'DATA', 'IMAGES', 'PRODUCTS', 'DOCUMENTS', and 'TOOLS'. The main content area is titled 'Data download' and lists several software tools under the 'Softwares' category. The 'SMART' and 'SWAP' tools are highlighted with a yellow box. The 'SMART' tool has a download count of 496, and 'SWAP' has a download count of 1731. The footer contains the NSMC logo, contact information, and copyright notice.

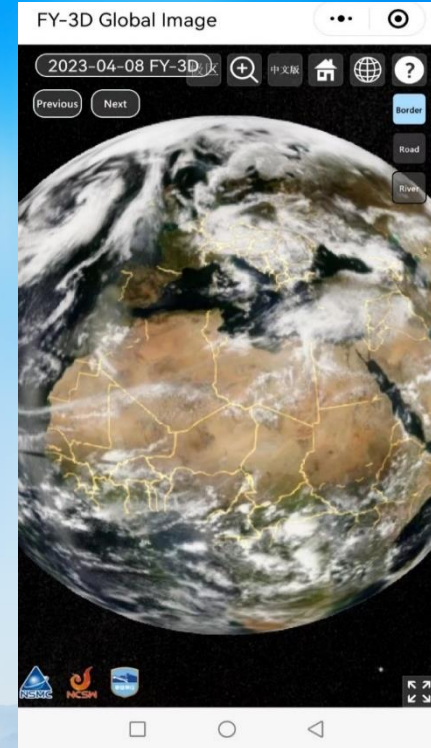
Software	Download times
FYDataService (DataDownload)	[881]
FENGYUN Toolkit v1.1 (Preprocessing)	[0]
SMART	[496]
SWAP	[1731]

Mobility applications -WeChat apple

FY-4B full disk



FY-4B live video





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1. FengYun Satellite Program Overview
2. Typical Applications and Examples
3. FengYun Satellite Data Access
4. FengYun Satellite Applications Tools
- 5. International Cooperation**
6. Actions and Plans



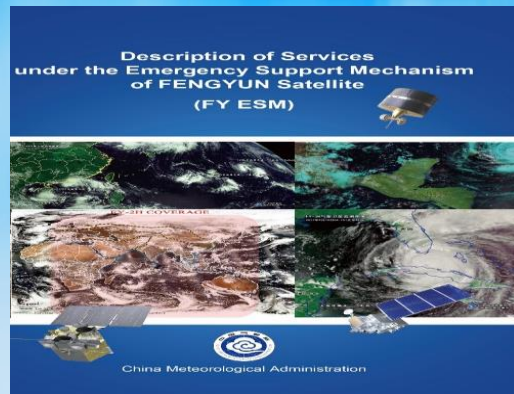
风云气象卫星服务全球129个国家和地区 Fengyun meteorological satellite serve 129 countries and regions



Data Receiving Equipment Handover in Malaysia



FY-2H DB Station Installation in Bangladesh



- **FY_ESM: 32 countries.**
- **Emergency support for 45 countries, 96 times from 2018, including FY_ESM, UN-SPIDER, CHARTER, etc.**

32 Countries

Laos, Myanmar, Iran, Maldives, Thailand, Philippines, Algeria, Malaysia, Uzbekistan, Tunisia, Mongolia, Nepal, New Zealand, Oman, Mozambique, Kyrgyzstan, Kingdom of Lesotho, Nigeria, Ethiopia, Guinea, Benin, Mauritius, Ghana, Portugal, Malawi, Armenia, Sri Lanka, Solomon Islands, Vanuatu Papua New Guinea, Pakistan, Côte d'Ivoire



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FY Satellite Services for Sustainable Development

- Strengthen cooperation with Vlab
- Training courses on FY application and data usage

- Bilateral and international scientific cooperation on weather, climate change and environment detection, etc.
- Built virtual scientific research community



- Bilateral and international data exchange
- Give helps on DB and CMACast data receiving
- Built a data sharing service based on public cloud
- Increase data and products

- Improve platforms based on GEO and LEO data face to Asia-Oceania area and Global observation
- Provide useful software and toolkit

- Strengthen cooperation on FY_ESM
- Increase response data and products



2023 FengYun Satellite User Conference

Meeting time: November 13 to 15, 2023

Meeting location: Xiamen, Fujian-Province, China

<http://sac347.nsmc.org.cn/nsmc/en/home/index.html>



**FENGYUN Satellite User
Conference (FYSUC)**

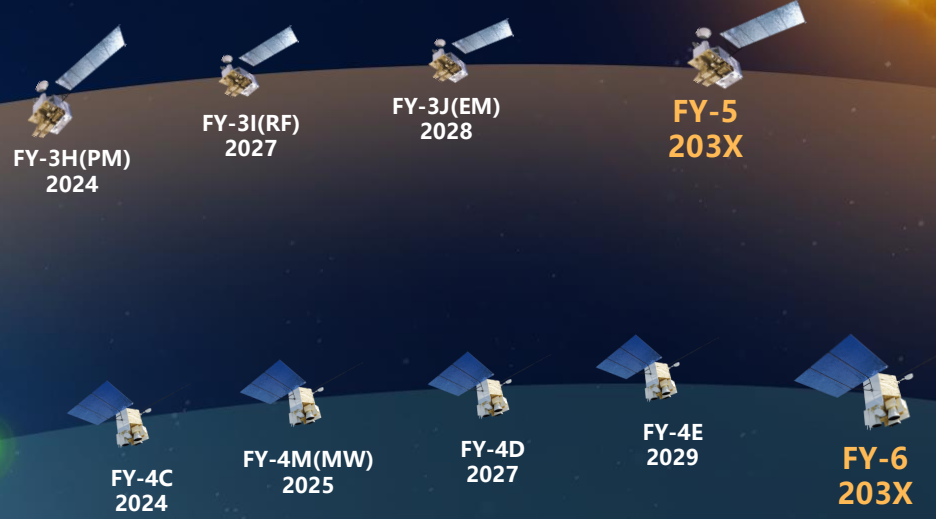
[Home](#) [Agenda](#) [About NSMC](#)

FengYun Satellite User Conference 2023

November 13 to 15, 2023
Xiamen, Fujian Province,
China

[Agenda](#)

The purpose of the conference is to establish a platform for international users of FengYun satellites, facilitating in-depth discussions regarding their applications and requirements, promoting the global integrated application of FengYun satellites to achieve maximum benefits across various application areas, and mitigating the impacts of hazardous weather, water, or climate events.



SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY 	6 CLEAN WATER AND SANITATION 	7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES 	11 SUSTAINABLE CITIES AND COMMUNITIES 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 	13 CLIMATE ACTION 	14 LIFE BELOW WATER 	15 LIFE ON LAND 	16 PEACE, JUSTICE AND STRONG INSTITUTIONS 	17 PARTNERSHIPS FOR THE GOALS 	

Useful links to FY satellite data and applications

- Nation Satellite Meteorological Center: <http://www.nsmc.org.cn/en>
- FENGYUN satellite data center: <http://data.nsmc.org.cn>
- FENGYUN Earth: <http://fyearth.nsmc.org.cn/>
- FENGYUN satellite data ftp server (user account required): <ftp://ftp.nsmc.org.cn>
- FENGYUN satellite data analysis platform: <http://rsapp.nsmc.org.cn/geofy/en/>
- FY-4A animation: <http://fy4.nsmc.org.cn/portal/en/theme/FY4A.html>
- SWAP2.0 (English): <http://rsapp.nsmc.org.cn/geofy/en>
- SWAP2.0 test version (English): http://rsapp.nsmc.org.cn/test_geofy/en
- FY-3 Global Daily Image: <https://fy4.nsmc.org.cn/mips/index.html>



Thanks for listening!

zhengw@cma.gov.cn